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Recommendations for a Sheep Management Program

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Good management and high production are essential for the maintenance of an efficient and highly profitable ewe flock. In recent years, very productive commercial flocks have grossed \$100 to \$120 per ewe per year on once-a-year lambing. Productivity will be even higher if the lambing program is successfully accelerated, if new breeds such as Finnish Landrace (noted for a high lambing rate) are used, or if we exert greater selection pressure for multiple births on our existing breeds.

On the basis of January 1, 1983, figures, Illinois ranked seventeenth in the nation for the number of stock sheep but fifth for the number of farms and ranches that raise sheep.

Most Illinois farm flocks are used for supplemental income, but recently, the number of farms on which sheep are the major livestock enterprise has begun to increase.

Sheep farming economically converts available pasture and roughage into pounds of lamb and wool. Although sheep are ideally suited to grassland agriculture, interest in confinement production is increasing, especially in the Midwest.

At present, gross return and net return per ewe cover a wide range. To ensure a high return per ewe, producers must pay special attention to the following conditions:

- At least 95 percent of the ewes in the flock at breeding time should lamb.
- The percentage of multiple births should be high, preferably 75 percent or more.
- Lamb mortality must be kept low, preferably below 15 percent, and ideally below 10 percent.
- Lambs should be marketed at desirable weights and at the highest possible price per pound.
- Ewes and rams should be heavy-shearing.
- Longevity of breeding stock should be taken into consideration.
- Wool must be marketed in a desirable condition and at the highest possible price per pound.

Stated briefly, good management is crucial in all phases of the sheep industry.

Systems of Sheep Production

Most Illinois farm flocks are commercial operations, used primarily to produce market lambs and wool. Illinois is also one of the leading states in purebred sheep production. The most important factors in market lamb production are the number of lambs weaned per ewe per year and the ability of lambs to gain rapidly and efficiently from birth to marketing.

Commercial production uses western ewes, native ewes, or both. Flock owners who use western ewes feel that these sheep have several advantages over native ewes. Western ewes are available in larger numbers; they can be obtained in more uniform groups; have fewer parasites; are usually hardier; and usually have heavier, more uniform fleeces.

Native ewes generally cost less per head, often show more desirable mutton conformation, and are frequently more productive. Many flock owners with native ewes also produce their own replacements.

Mature native and western ewes with solid mouths are available on the market each fall. If these are ewes that have been sold in order to decrease flock numbers, they may be a good investment. However, many of these marketed ewes have been culled because they did not lamb or raise a lamb, because they raised lightweight or inferior quality lambs, or had unsound udders.

Broken-mouth ewes and gummurs are also available. Most of them have been good producers or they would not have been retained so long in the original flock. These ewes generally require extra care and management. Buyers should also be prepared to raise some lambs on milk replacer.

Another system of commercial production that is attracting producers in the Midwest involves the production and sale of crossbred replacement ewe lambs and yearlings. At one time, most purchased replacement ewes came from the West and Southwest, but the pattern is slowly changing.

The system of purebred production is used chiefly for providing breeding stock for commercial flocks and for other purebred flocks. This system requires good individual sheep but not a large flock. Owners of purebred flocks must be highly competent and also capable of merchandising sheep. Moreover, owners should realize the value of good production records and use them in breeding and selection programs. When selecting a breed, consider the market for and the availability of breeding stock in your area. If several breeds are in

demand, your decision can be based on your personal preference and what is available.

Specializing in Sheep Production

In recent years, farmers have been taking a more serious look at sheep production as a profitable income alternative. There is great potential in this age of specialization for large ewe flock operations not only in the grassland areas but also in the heart of the cash-grain areas. The number of flocks with 200 or more ewes is increasing, and several flocks have 400 or more ewes. Farmers with flocks too small for economical production should expand the enterprise so that sheep production contributes a greater percentage to the total farm income. Production can be intensified in a pasture system or in drylot, or the two systems can be combined. Instead of limiting flock size to 25 or 30 ewes, those sheep producers who can, should increase flocks to 100 or preferably more. This increase will, of course, warrant more attention to management.

Farmers who plan to specialize in sheep production may want to consider some automation, especially in relation to feeding and feed handling. Automation increases the overall capital cost, but it greatly reduces the total labor required.

In general, sheep producers have been slow to accept new ideas, and this has hurt the sheep industry. Much information is available today that can help people to make production more efficient and profitable.

The interest in using slotted floors continues to grow, and Illinois remains a leader in conducting research in this area. In fact, some Illinois sheep producers have been utilizing slotted floors successfully for many years. Some of the advantages of this system are as follows: elimination of bedding; great reduction or elimination of internal parasites; improved performance of lambs during warm weather; less floor space per animal; improved control of foot rot; and fewer losses because of predators.

The information compiled in recent years concerning ewe and ram fertility, confinement rearing, early weaning, creep feeding, slotted floors, accelerated lambing, synchronization, ewe feeding and management, production testing, and carcass evaluation is available to help you to profitably expand your sheep operation. There is no good reason why the sheep industry should not take advantage of recent advances and maximize production.



Slotted floors have been used successfully by producers for many years.

Crossbreeding for Commercial Lamb Production

Commercial sheep producers should consider the merits of crossbreeding and how a sound crossbreeding program can be established. Crossbreeding has some definite advantages over straightbreeding for commercial lamb production. Crossbred lambs from straightbred parents usually gain more rapidly than the average of the straightbred lambs from the parent breeds. Moreover, crossbred lambs are usually more hardy and vigorous and have a lower mortality rate.

Using crossbred ewes offers additional advantages. Crossbred ewes are usually more fertile and raise a higher percentage of their lambs than do straightbred ewes. In addition, the lambing percentage and milk production of crossbred ewes are usually greater than the average of the breeds involved in the cross. Approximately half the advantage of crossbreeding lies with the crossbred lamb and the rest of the advantage is obtained from using crossbred ewes and breeding them to a growthy ram of a third breed. Research has shown that two-breed cross ewes mated to a ram of a third breed will wean approximately 35 percent more pounds of lamb per ewe mated than straightbred ewes producing straightbred lambs.

In evaluating breeds for crossbreeding, one usually divides the breeds into ewe and ram breeds. Among ewe breeds you should look for early lambing, lambing rate, ease of lambing, maternal instinct, milk production, longevity, and wool quality and quantity. Early sexual maturity and potential for accelerated lambing may also be important considerations. For the ram breeds, growthiness, carcass merit, sexual aggressiveness, testicle size at six months, male fertility, and lamb survival are important qualities.

Rambouillet, Merino, Corriedale, Columbia, Targhee, and Polypay are the ewe breeds usually considered for crossbreeding. Ram breeds are Suffolk, Hampshire, Shropshire, Oxford, and Southdown; Suffolks and Hampshires are the most widely used at the present. Dorsets and Montadales can fit into either category. Finnish Landrace must be considered a strong ewe breed because of the high lambing rate, even though inadequacies of fleece quality and quantity are a serious weakness of the breed. Finnish Landrace crossbred lambs, though small at birth, are extremely hardy. Finnish Landrace crossed with any of the other ewe breeds produce excellent F1 ewes that can be bred to Suffolk or Hampshire rams for excellent market lamb production. Well-managed, mature crossbred ewes that are half Finnish Landrace commonly produce a 200 to 250 percent lamb crop. One-fourth Finnish Landrace ewes commonly produce a 175 to 200 percent lamb crop, and their lambs will gain comparably to the offspring of most commercial ewes. Dorset-Rambouillet crossbred ewes also make excellent F1 ewes, especially for an accelerated lambing program. The Barbados Blackbelly, a hair sheep developed in the Caribbean, is another breed that is desirable for breeding productive crossbred ewes, especially for accelerated lambing programs in hot, humid areas. Targhee-Suffolk and Rambouillet-Suffolk crossbred ewes are excellent for winter and spring lambing programs. Of the breeds not already mentioned, Romney, Cotswold, Lincoln, Cheviot, North County Cheviot, and Tunis would be considered more as ewe breeds than as ram breeds.

Cheviot, Southdown, Finnish Landrace (Finn), Finnish Landrace cross, Barbados Blackbelly, and Barbados-cross rams should be considered when you are selecting rams to breed to commercial ewe lambs. These breeds tend to produce lambs that have light birth weights but that are still quite vigorous at birth.

Not all crosses or breeds will work equally well in all parts of the country. For example, Border Leicester crosses, which have been found to be very productive in North Dakota, have not performed well at the Dixon Springs Agricultural Center in Illinois, where much higher temperatures and humidity prevail. Another observation at Dixon

Springs Agricultural Center is that fat lambs that are one-fourth or one-half Finnish Landrace may sometimes suffer from heat stress unless they are part Rambouillet.

During the past several years, much interest has been expressed in using Finn-cross rams to get one-fourth Finn replacement ewes. Finn-Dorset and Finn-Rambouillet crossbred rams have been very popular in this regard. Finn-Suffolk rams can also be considered, depending on the breeding of the ewes.

Following a crossbreeding program poses some problems. You have to either buy crossbred ewes or produce your own. If you buy crossbred replacement ewes, you will not have your own production records to help with the selection process. If you produce your own F1 ewes, you will need some straightbreds to produce the desired crosses.

One way to simplify a crossbreeding program is to follow a two-breed or three-breed rotational crossing program, the latter being the most desirable. A two-breed rotational crossing program is possible where ewes of breed A are bred to a ram of breed B. The replacement ewes from this cross are then bred to a ram of breed A, and so the



In commercial lamb production, crossbred ewes (shown here) have some definite advantages over straightbred ewes.

cycle continues. This system works well for small flocks, but does not provide as much benefit from heterosis (hybrid vigor) as does the three-breed rotational cross.

A good example of a three-breed rotational cross, using Rambouillets, Dorsets, and Suffolks is as follows: Rambouillet ewes are bred to a Dorset ram. The replacement ewes from this cross are bred to a Suffolk ram, with the resulting replacement ewes being bred to a Rambouillet ram and so on, so that the three breeds continue to rotate.

Here are some additional questions that you should consider when developing a crossbreeding program:

- How big a ewe do you want to work with?
- Do you want to breed ewe lambs?
- Do you plan to lamb early or late?
- Are you interested in accelerated lambing?
- Are you willing to work with ewes that have the potential of a 200 percent or larger lamb crop?

To be highly successful, a crossbreeding program must be well planned and well managed, and it must use superior rams (preferably performance tested). Moreover, an excellent set of records is necessary to measure the results of the crossing program. High-producing ewes are essential for a highly profitable operation.

Selecting Ewes and Rams

Selecting good breeding stock to start or expand an operation, whether purebred or commercial, is an extremely important part of livestock management. To make the most rapid progress in flock improvement, you must use outstanding stud rams, and it is here that many producers are most negligent. The selection of a stud ram is a major decision and not something that is done on the spur of the moment. You cannot expect to buy an outstanding sire for market price. Neither can you expect outstanding results from a scrub. Give some time and thought to the selection and management of your breeding stock.

When you select breeding stock, consider these criteria:

1. Condition of birth (single, twin, or triplet). Your first choice should always be ewes and rams of multiple birth from highly productive ewes. You can increase lambing percentage by selecting for multiple births. Under midwestern conditions, a good set of twins is



In addition to visual appraisal, use production records to help evaluate potential stud rams.

more profitable than a good single lamb. The idea that twinning is economically important is not new; in 1837 Youatt wrote: "Ewes yearly by twinning/Rich masters do make;/The lambs from such twinners/For breeders go take."

Your second choice should be single ewes and rams from highly productive ewes. In general, a single-born ewe whose mother has given birth to and weaned ten lambs from six lambings will be more highly productive than a twin-born ewe whose mother has given birth to and weaned only seven lambs from six lambings.

Many producers need to be cured of the "single syndrome," where they consider a good single lamb as ideal, and more than two lambs from a ewe as a nuisance. This problem, which has been with us for generations, has been a great stumbling block to improving ewe productivity in this country. High production *and* efficient production are the keys to a profitable sheep operation.

2. **Growthiness (size for age).** Select rapid-gaining sheep that meet your other standards. Rapid-gaining animals usually make the most efficient use of feed and can be marketed at a younger age.

Your goal should be to have your lambs attain 60-day adjusted weights of at least 55 pounds (if creep fed). When this weight is reached, raise your goal to 60 pounds. Then select breeding stock with the gaining ability to produce such lambs. Many lambs of the larger breeds will exceed 70 pounds at 60 days (if creep fed). Adjust your specific goals according to your management program and the breed or breed crosses you are working with.

3. **Previous performance.** When you buy breeding stock, get all the performance information you can — such factors as weight at 60, 90, or 120 days and weight at one year of age. Find out the performance of their progeny, if any, and check the performance of sires and dams. Some breeders have carcass information available, so check on this also.

Would it not be helpful to have complete production information on the new stud ram or replacement ewes you are interested in buying? Most sale catalogs contain little if any such information. Ideally, the information given on page 10 should be readily available on sale sheep.

4. **Conformation.** The ideal conformation probably varies from one breed to another. However, sometimes you can find almost as much variation between animals of the same breed as you can between different breeds. In general, a sheep with the following qualities has a desirable conformation: (a) adequate frame for age; (b) smooth shoulders; (c) fullness through the heart area and the spring of ribs; (d) long body, with major emphasis on length from the last rib to the dock; (e) wide and straight top; (f) long, wide, and level rump; (g) deep, thick, and full leg of lamb or mutton; (h) adequate bone; and (i) overall balance (blending together of body parts).

Remember, however, that the relationship between these conformation traits and animal performance is relatively low. Use a good set of production records to help you evaluate and select instead of relying only on visual appraisal.

5. **Soundness.**

- a. *Feet and legs.* When their feet are well trimmed, sheep should be able to stand squarely on them. Select sheep that have strong pasterns and straight legs with plenty of width between them. Crooked legs and weak pasterns can decrease an animal's ability to move and perform normally and can decrease its years of reproductive usefulness.

Sire - Super Ram (TW)
(1-14-79)

Super Stud 1-10-82 (TW)

Dam - Super Ewe (TR)
(1-10-76)

Birth weight = 11 lb
60-day adj. wt.^a = 70 lb (TW = 65 lb)
60-day adj. wt. ratio = 115
ADG^b for 63 days at ram test station = 1.30
ADG ratio at test station = 120
Was exposed to 8 ewes which settled in 30 days
The 8 ewes had 14 lambs and all lived to weaning
12-month fleece wt. = 14 lb

Super Ram (TW)

Birth weight = 10 lb
60-day adj. wt. = 75 lb (twin
55 lb)
60-day adj. wt. ratio = 120
Avg. 12-month fleece
weight = 15 lb
Mated to 150 ewes in 3 years
90% of ewes settled during
first two heat cycles
175% lamb crop born (live)
10% mortality from birth to
weaning
Avg. 60-day adj. wt. of all
lambs = 60 lb
20 lambs slaughtered for car-
cass data with avg. loin
eyes of 2.85 for a 55-lb
carcass
75% of daughters kept for
replacements cycled by 8
months of age

Super Ewe (TR)

Birth weight = 9 lb
60-day adj. wt. = 60 lb
60-day adj. wt. ratio = 105
Lambd 8 times in 6 years,
no assistance needed
Avg. 12-month fleece
wt. = 10 lb
Sixteen lambs were born and
15 were weaned
Avg. 60-day adj. wt. = 68 lb
Three lambs slaughtered had
avg. loin eye areas of 2.90
square inches for a 55-lb
carcass
Six daughters and four sons
have been kept for re-
placements

^aadj. wt. = adjusted weight. ^bADG = average daily gain.

**Complete production information as given above would help sheep pro-
ducers greatly in the purchase of sheep.**

- b. *Mouth.* Check the sheep's mouth for age, condition of the eight incisors, and jaw malformations such as monkey mouth or parrot mouth.
- c. *Udder.* If ewes have produced at least one lamb crop, check their udders to be sure that both teats are present and functioning and that there are no lumps or hard areas.
- d. *Testicle size and soundness.* Testicle size as measured with a flexible tape at the greatest scrotal circumference is probably the best indicator of potential fertility. The measurement is a simple one. Testicular growth is greatest at puberty when the ram begins to function sexually. Average scrotal circumference of ram lambs at five to seven months of age (puberty) is about 30 to 32 centimeters or 12 to 13 inches. A lamb with much smaller testicles at that age may be either a late-maturing ram or have low fertility. Such lambs are very likely to sire offspring with those same traits. In selecting a stud ram for raising breeding stock, make sure that testicle development at six to seven months of age is above average.

When scrotal circumference is being determined, the testicles should also be examined for any abnormalities or differences. Use only those rams with very uniform and normal testicles, and keep a record of changes in scrotal circumference. Measurements should be made at least twice yearly — two months before the breeding season and at the beginning of the breeding season.

6. **Wool.** Select heavy-shearing sheep that have dense, uniform, high-quality fleeces with no dark fiber. This factor, which is often neglected in sheep selection, should be taken into consideration because wool makes an important contribution to the gross income from a sheep enterprise.

7. **Age.** There are several things to consider in deciding what age ewes to buy: the quality of the various age groups, the soundness of older ewes, price differences, the amount of production data available, and the years of expected production. Ewes generally reach peak productivity at four to six years of age. Even though yearlings cost more than older ewes, they have sounder udders, more productive years ahead of them, and a lower death rate. Some sheep producers prefer to buy a mixed age group with equal numbers of yearlings and older ewes.

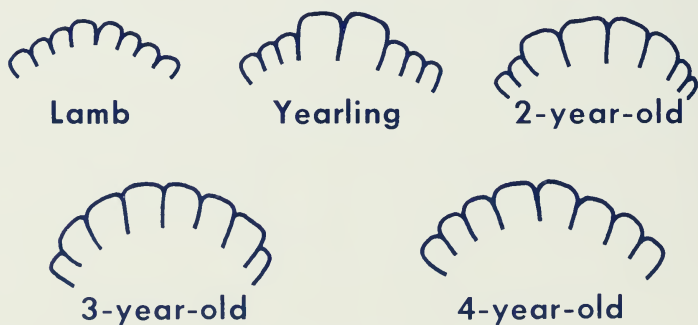
In starting into purebred production, your best investment may be to use highly productive older ewes with several years of production still left rather than to start with a group of high-priced yearling ewes or ewe lambs. Here also, a mixed age group may have some advantages.

It has been traditional for most sheep producers to lamb ewes first at two years of age. However, because ewe lambs can successfully lamb as yearlings, this breeding option is becoming increasingly popular. The ewe lambs must be well grown and fed well during pregnancy and lactation. Special attention must also be given to their nutrition after they wean their first lambs. Yearling ewes should be handled as a separate unit, not mixed with the older ewes. If they are well managed, their mature size will not be affected when they are lambed as yearlings.

The age of the ram will determine how many ewes he can serve. Under normal field-mating conditions, a ram lamb can be used on about 15 ewes, a yearling ram on 25 to 35, and an aged ram on 35 to 45. A good rule of thumb is to have 3 mature rams for every 100 ewes in the breeding flock.

The age of sheep can be determined by their teeth. Lambs are born with eight milk teeth, or incisors, arranged in four pairs in the lower jaw. The center pair is shed at approximately one year and replaced by larger, permanent teeth. When the sheep is two years old, the second pair of permanent teeth replaces the second pair of milk teeth; and at three and four years the third and fourth pairs of permanent teeth appear. At four years of age the sheep has a "full mouth." When a ewe loses some of her incisor teeth, she is called a "broken mouth" ewe. Ewes that have lost all their incisors are called "gummers."

Lambs and yearlings that are fed for maximum growth will often get their yearling and two-year-old teeth at a younger age than animals fed in a more conventional manner.



The age of sheep can be determined by their teeth.

8. **Sex character.** Ewes should look feminine and rams should look masculine. Masculine rams are generally more rugged, active, and aggressive than rams that lack this quality.

9. **Breed type.** This is an important consideration in purebred livestock; without it breed identity is lost. Even so, breed type should not overshadow other criteria. Breed type should be appraised along with the other qualities listed in this section.



High production is important for maximum profit.

Production Records for a More Profitable Flock

It is hard to determine anything specific about the productivity of a commercial or purebred ewe flock unless you have some accurate production records on hand to evaluate. Yet many purebred and commercial sheep producers show no interest at all in keeping production records on their flocks, and some purebred breeders prefer to let show-ring winnings be the only criterion for flock evaluation. True, the show ring is one system of evaluation, but it is not the only way, and it is not the best way. A state fair champion ram has not really "won his spurs" until he has proved to be a highly fertile ram; has settled a high percentage of ewes during their first two heat cycles; has sired vigorous, fast-growing, well-muscled lambs that are acceptable to the industry; and has also sired highly productive sons and daughters. All flock owners, regardless of the breeds or breed crosses they raise, should strive to develop more productive animals. *Why be satisfied with a good single lamb when a good set of twins will make you more money?*

Production records can be used as follows:

- To measure flock productivity
- To provide permanent records
- To identify top-producing ewes so their lambs can be kept for breeding stock
- To help cull low producers
- To evaluate ram performance
- To show differences in the gaining ability of lambs
- To supplement visual appraisal

Production records point out the large differences in ewe productivity and lamb gains that can exist within a flock (Tables 1 and 2).

Without some sort of production records, it is difficult to determine if progress is being made in flock improvement. Such factors as weaning weights, fleece weights, lambing percentage, and percentage of death loss have a direct effect on income and profit from the enterprise.

The importance of production records is very evident from the research carried out at the University of Wyoming. Results indicate that good progress can be made in increasing lambing percentage by selection. The Wyoming study used only western white-faced ewes (with no Finnish Landrace breeding). The primary purpose of the study was to evaluate the progress that can be made toward increasing

Table 1. Actual Pounds of Lamb Weaned at 60 Days from High- and Low-Producing Ewes

Ewes raising singles		Ewes raising twins	
High	Low	High	Low
70	34	111	63
69	37	109	75
69	39	109	77
65	40	106	79
65	41	104	81

Table 2. Average Daily Gains from Birth to 60 Days (Weaning) for Fast- and Slow-Gaining Lambs

Twin ram lambs		Twin ewe lambs	
High	Low	High	Low
0.97	0.43	0.88	0.40
0.94	0.49	0.86	0.44
0.92	0.54	0.83	0.45
0.88	0.55	0.76	0.51
0.87	0.56	0.76	0.52

the proportion of twin births in the more widely used and readily available breeds by selection for an extreme (triplet) birth.

Only triplet-born sires were used in the project from the 1970 breeding season to the end of the project. The results of this study are presented in Table 3.

Records can be very simple or quite complex, depending on the needs and goals of the producer. Some producers say that they do not have time to keep records; but you really cannot afford *not* to take the time. Why guess about the overall productivity of your flock or of individual ewes when there is a more accurate way of figuring things?

Probably the simplest record system for commercial sheep producers is that of ear-notching lambs at birth, using a coding system for type of birth in one ear and week of birth in the other. This helps evaluate lambs for size and weight on the basis of their approximate age and type of birth. It does not, however, identify lambs with their mothers or with specific sires.

Table 3. Average Performance per Year in Wyoming Selection Study

Year lambled	No. of ewes	Avg. age at mating	Lambing rate		Ewes dry or dead
			Ewes mated	Ewes lambing	
		yr.	%	%	%
1970	184	2.69	132.0	143.0	9.3
1971	172	2.66	135.0	152.0	11.0
1972	162	2.36	135.0	149.0	9.3
1973	181	2.65	160.0	171.0	5.5
1974	183	2.76	159.0	169.2	6.0
1975	182	2.96	153.8	155.6	2.2
1976	184	3.12	165.2	167.9	1.7
1977	184	3.14	189.7	197.2	3.8
1978	188	3.32	202.1	211.1	4.3
1979	180	3.36	194.4	203.5	4.4
1980	181	3.45	201.0	212.3	5.5

Ideally, all ewes and lambs should be permanently identified so that you can evaluate each ewe's production and each ram used in the flock. Lambs should be weighed at weaning time and their weights adjusted to a standard age such as 60, 90, or 120 days. Weaning weights should also be adjusted for sex, age of dam, type of birth, and type of rearing. Recommended adjustment factors are given in Table 4.

After weaning, you may want to feed all the ram lambs together or by sire groups and determine average daily gain for the next 40 to 60 days. If the lambs are fed by sire groups, you could check for differences in feed efficiency as well as in average daily gain between sire groups. *The average daily gain for this postweaning period is more highly heritable than gain from birth to weaning, because you have eliminated the influence of the ewe's milk production.*

Although very few people obtain yearling weights on rams and ewes, those are important data because yearling weight is a highly heritable trait and strongly related to growth rate from weaning to traditional market weights. If you are breeding ewe lambs or using ram lambs to breed with, or both, then six- or eight-month weights may be more meaningful to you.

Fleece weights are also part of a total evaluation program and should be obtained for each breeding animal in the flock. You should also obtain carcass information on some of your lambs to determine whether you are producing desirable meat-type lambs.

Table 4. Recommended Weight Adjustment Factors^a

	Age of dam (years)		
	3 to 6	2 or over 6	1
Ewe lamb			
Single	1.00	1.09	1.22
Twin — raised as twin	1.11	1.20	1.33
Twin — raised as single	1.05	1.14	1.28
Triplet — raised as triplet	1.22	1.33	1.46
Triplet — raised as twin	1.17	1.28	1.42
Triplet — raised as single	1.11	1.21	1.36
Wether			
Single	0.97	1.06	1.19
Twin — raised as twin	1.08	1.17	1.30
Twin — raised as single	1.02	1.11	1.25
Triplet — raised as triplet	1.19	1.30	1.43
Triplet — raised as twin	1.14	1.25	1.39
Triplet — raised as single	1.08	1.18	1.33
Ram lamb			
Single	0.89	0.98	1.11
Twin — raised as twin	1.00	1.09	1.22
Twin — raised as single	0.94	1.03	1.17
Triplet — raised as triplet	1.11	1.22	1.35
Triplet — raised as twin	1.06	1.17	1.31
Triplet — raised as single	1.00	1.10	1.25

^a Multiply the 60-, 90-, or 120-day weight by the appropriate adjustment factor. For example, a three-year-old ewe raises twins, with the ram lamb weighing 55 pounds at 60 days and the ewe lamb weighing 50 pounds at 60 days. To determine the 60-day adjusted weight of the ram lamb, multiply 55 times 1 (55 pounds). For the ewe lamb, multiply 50 times 1.11 (55.5 pounds). *Remember that all weights are adjusted on the basis of a single ewe lamb from a mature ewe.*

SOURCE: 1968 National Sheep Extension Committee Report, "Recommendations for Uniform Sheep Selection Programs."

Copies of three production record forms are shown on pages 19 to 21. Notice that on the Barn Record and the Individual Ewe Production Record you can calculate either average daily gain from birth to weaning or calculate a weight per day of age at weaning. Weaning weights can be adjusted to 60, 90, or 120 days of age. Example records have been placed on the forms for illustrative purposes.

The production record forms and copies of Tables 4 and 5 are available from the Livestock Extension Office, 326 Mumford Hall, 1301 West Gregory Drive, Urbana, Illinois 61801. Information on the computerized Ohio Sheep Production Testing Program and the Wisconsin Sheep Improvement Program is also available from this office.

Table 5. Age-in-Days Tabulation Chart^{a, b}

Day of month	Month											
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
1	1	31	62	93	121	152	182	213	243	274	305	335
2	2	32	63	94	122	153	183	214	244	275	306	336
3	3	33	64	95	123	154	184	215	245	276	307	337
4	4	34	65	96	124	155	185	216	246	277	308	338
5	5	35	66	97	125	156	186	217	247	278	309	339
6	6	36	67	98	126	157	187	218	248	279	310	340
7	7	37	68	99	127	158	188	219	249	280	311	341
8	8	38	69	100	128	159	189	220	250	281	312	342
9	9	39	70	101	129	160	190	221	251	282	313	343
10	10	40	71	102	130	161	191	222	252	283	314	344
11	11	41	72	103	131	162	192	223	253	284	315	345
12	12	42	73	104	132	163	193	224	254	285	316	346
13	13	43	74	105	133	164	194	225	255	286	317	347
14	14	44	75	106	134	165	195	226	256	287	318	348
15	15	45	76	107	135	166	196	227	257	288	319	349
16	16	46	77	108	136	167	197	228	258	289	320	350
17	17	47	78	109	137	168	198	229	259	290	321	351
18	18	48	79	110	138	169	199	230	260	291	322	352
19	19	49	80	111	139	170	200	231	261	292	323	353
20	20	50	81	112	140	171	201	232	262	293	324	354
21	21	51	82	113	141	172	202	233	263	294	325	355
22	22	52	83	114	142	173	203	234	264	295	326	356
23	23	53	84	115	143	174	204	235	265	296	327	357
24	24	54	85	116	144	175	205	236	266	297	328	358
25	25	55	86	117	145	176	206	237	267	298	329	359
26	26	56	87	118	146	177	207	238	268	299	330	360
27	27	57	88	119	147	178	208	239	269	300	331	361
28	28	58	89	120	148	179	209	240	270	301	332	362
29	29	59	90	(^b)	149	180	210	241	271	302	333	363
30	30	60	91	...	150	181	211	242	272	303	334	364
31	...	61	92	...	151	...	212	...	273	304	...	365

^a For example, assume that a lamb is born on February 1 and weighed on May 12. Use the day-of-month column to find the first day under February; the figure found is 93. Do the same for May 12; this figure is 193. Subtract (193 minus 93) for the age of the lamb in days. The result is 100 days.

^b In leap years, for a lamb born after February 28, add 1 day to the tabulated number.

BARN RECORD

Owner John Doe Breed Hampshire Year 1983

Ewe no.		Lambing data				Weaning data				Wool wt.	Remarks				
		Sire	Date	No.	Sex	Wt.	Date	Wt.	Age			(ADG or wt./day of age)	(60, 90, or 120-day wt.)	Unadj.	Adj.*
77-26	T720	1-10	83-1	R	10		3-21	57	70	.67	50	50		Breech birth	
			83-2	R	9			54		.64	47.5	47.5			
78-21		1-12	83-3	E	11			60	68	.72	54	54			
80-50		1-13	83-4	E	9			47	67	.57	43	47.5		9	
			83-5	E	8			51		.64	46.5	51.5			
78-64		1-16	83-6	R	10			60	64	.78	57	57			9
			83-7	E	8			57		.77	54	60			
79-19		1-17	83-8	R	13			70	63	.91	67.5	60		9.5 Pulled	
80-35		1-19	83-9	E	10			52	61	.69	51.5	57			12
			83-10	E	10			54		.72	53	59			
78-44		1-19	83-11	E	12			65	61	.87	64	64		8	

*Use adjustment factors from Table 4.

20

Ewe No. _____

7

- ¹Determine from Table 5.
- ²Use adjustment factors from Table 4.

3. To determine the ewe index, add the 60-, 90-, or 120-day adjusted weight of her lamb or lambs, plus wool credit (wool weight X 3).

YEARLING WEIGHT RECORD

Owner John Doe

Breed Hampshire

Year 1983

Lambing data				Weaning data			Yearling data				Remarks			
No.	Sire	Date	Sex	Type of birth	Wt.	1982 Date	Wt.	Age	1983 Date	Wt.		Age	(ADG) or wt./day of age	365.*2 day wt.
82-1	T120	1-10	R	TW.	10	3-21	57	70	1-25	185	380	.413	179	
82-6		1-16		TW.	10		60	64		210	374	.484	206	
82-8		1-17		S.	13		70	63		225	373	.500	221	
82-5		1-13	E	TW.	8		51	67		155	377	.335	151	
82-7		1-16		TW.	8		57	64		185	374	.413	181	
82-9		1-19		TW.	10		52	61		170	371	.380	168	
82-10		1-19		TW.	10		54	61		165	371	.358	163	
82-11		1-19		S.	12		65	61		180	371	.371	178	

*365-day weight may be calculated in any of these ways:

1. (ADG from birth to yearling weigh date X 365) + birth weight.
2. ADG from weaning to yearling weigh date X (365 - weaning age) + weaning weight.
3. Weight per day of age X 365.

Ram Testing Stations

A place to get some good comparative data on ram lambs from several different flocks is a ram testing station. These stations are also good places for producers to purchase performance-tested rams. In addition, the stations allow breeders of replacement animals to compare rams from their breeding programs with rams of other breeders to determine the genetic progress they are making.

Such facilities are available in many Midwest states including Illinois. Lambs are brought in between 7 and 11 weeks of age (this varies from station to station), given a week's warm-up period, and then tested for 60 to 80 days. Most stations are not set up to provide feed efficiency data, only average daily gain. The lambs are weighed every 2 or 3 weeks, and average daily gain is calculated for each weigh period as well as the entire test. A gain ratio is calculated that compares each lamb with the average of its breed group.

Lambs are evaluated for soundness at the end of the test, and many test stations measure the scrotal circumference of each lamb at the end of the test. Some stations take an on-test measurement as well.

Evaluating Sire Performance

Records indicate that sire performance varies considerably within each breed and within many flocks. This means that you should evaluate sire performance as well as individual ewe performance. Use the following data to make this evaluation:

1. Percentage of exposed ewes that actually lamb
2. Percentage of ewes that settle during the first two cycles
3. Percentage of lamb crop born per ewe exposed
4. Percentage of lamb crop born per ewe lambing
5. Percentage of lamb crop weaned per ewe exposed
6. Percentage of lamb crop weaned per ewe lambing
7. Percentage of mortality from birth to weaning
8. Percentage of ewes that have little or no difficulty lambing
9. Average 60-, 90-, or 120-day adjusted weight of weaned lambs
10. Complete carcass evaluation for at least 5 lambs per sire, preferably for 10
11. Average 365-day weights of yearling ewes and rams

Considerations During the Breeding Season

Lambing Season

One of the major decisions a flock owner must make is whether to plan an early-lambing program (late December to early March) or a late-lambing program (starting in late March). Early lambing has these advantages: lambs usually are sold on a higher market; lambs gain more rapidly; hot weather and internal parasites are not major problems; lambs can be sold without being put on pasture; and labor requirements for lambing will come at a slack time of the year.

Late lambing has the following advantages: building and equipment requirements are fewer; feed costs per ewe are lower; the number of lambs born per ewe may increase because of later breeding; more lambs may survive because of better weather at lambing; and lambs can make maximum use of pasture forage and be marketed directly from pasture with a minimum amount of grain feeding.

In recent years interest has increased in fall lambing (September 1 to December 1) and in accelerated lambing. The advantages of fall lambing are as follows: favorable weather; better use of equipment; lower feed and labor requirements; good prices for lambs; and the possibility for accelerated lambing. The disadvantages are that a higher percentage of ewes fail to lamb; birth weights are smaller; lambing percentages are lower; and at times ewes have lower milk production.

Accelerated Lambing

Two relatively new management practices are currently being developed by some sheep producers: (1) accelerated lambing (three lamb crops in two years) and (2) synchronized breeding and lambing (lambings grouped into three- to seven-day intervals). Some sheep producers who practice accelerated lambing combine synchronization with it.

Accelerated lambing is a must for those who go to a drylot or semiconfinement type of operation. Certain breeds are more adapted to fall lambing, and therefore accelerated lambing, than others. Rambouillet, Dorset, Blackbelly Barbados, Polypay and Finnsheep (in the northern United States) seem to have the lead in this respect. Many Targhee and Corriedale flocks also have quite a few fall lambs.

For the ewe to lamb every eight months, the lambs must be weaned at 60 days or less. This leaves 30 days in which to rebreed the ewe.

Controlling the estrous cycle of a ewe or stimulating the ewe to cycle during the anestrous period begins with progesterone hormone treatments for a period of approximately 14 days. Feed additives, vaginal tampons, and silastic implants impregnated with progesterone or progesterone-like substances have been used for this purpose. Withdrawal of these progesterone sources during the normal breeding season will result in a large percentage of the ewes coming into heat within one to three days following withdrawal. During the anestrous period, the progesterone treatment should be followed by an additional hormone treatment to ensure follicular development and subsequent ovulation. Pregnant mare's serum (PMS), which contains follicle-stimulating hormones, is often used for this follow-up treatment.

Although this system has been shown to be quite effective in stimulating ewes to lamb out of season, none of the products for the progesterone hormone treatment are at present readily available to U.S. producers. It is hoped that such products will be approved in this country in the near future.

A successful accelerated lambing program requires careful management. Many of the problems encountered with accelerated lambing may center around the low fertility of many rams in the spring and early summer. Moreover, when ewes are synchronized, more rams are generally needed than would be required for a conventional pasture-mating system.

Using a hand-mating system or limiting the number of matings per ewe is essential if ewes are synchronized. A vigorous ram should be able to breed from five to eight ewes per day under a hand-mating system. Ewes should be mated once every 24 hours as long as they remain in estrus.

Tagging the Ewes

All ewes with long fleece or with a lot of manure around the rear end should be tagged before the ram is turned in. Tagging means trimming the wool around the dock area so it will be easier for the ram to mate with the ewes.

Effect of the Ram on Ewe Fertility

Although the ram was once considered to have no effect on the lambing percentage, research reports indicate that some rams consistently sire more multiple births than others. According to an Ohio report, the ram exerts a highly significant influence on both the number of lambs born per ewe exposed and the number of lambs born per ewe lambing. And an Idaho report indicates that over a six-year period,

one particular ram sired an average of 32.8 percent more single lambs each year than did other rams used in the same flock.

Data from the Dixon Springs Agricultural Center also indicate that great differences exist in ram breeding performance. A study of the breeding data for 23 rams shows that some rams settled only 25 percent or less of the ewes during the first two heat periods. Other rams, however, settled over 90 percent of the ewes during the first two heat periods. The following paragraph, adapted from *The Sheepman's Production Handbook*, indicates that rams also have other effects on ewe performance.

The presence of a ram appears to have some psychological effect, triggered by sight, sound, or smell, on ovulation and estrual activity. This stimulus is not as pronounced when the ram is constantly associated with the ewes. Introducing a ram (fertile or surgically sterilized) near the end of the anestrous period can induce estrus and ovulation earlier than would normally occur without the presence of a ram. Ewes in the transitional state — between the nonbreeding and breeding season — have been shown to ovulate without showing estrus (silent estrus) within six days after being placed with or near a ram. Estrus accompanied by ovulation then occurs one estrous cycle later. This effect is not seen if the rams are placed with the ewes earlier in the anestrous period and simply left with the ewes. They must be introduced at the critical time of transition. The result is a grouping of breeding (and probably lambing) dates rather than an increase in the number of fertilized eggs.

No increase in lambing percentage should be expected from teased ewes. Nonteaed ewes tend to breed one heat period later than properly teased ewes, and their breeding season tends to be longer. Teaser rams should be aggressive, surgically sterilized rams. They should be left with the ewes 10 to 14 days, then replaced with the rested, fertile rams that are intended to sire the lamb crop. Teasing has been shown to be most beneficial among purebred ewes, especially in breeds that tend to have more distinct breeding seasons. It would certainly be advantageous for stimulating ewe lambs to cycle. Using a marking harness on teaser rams running with ewe lambs helps in identifying and selecting ewe lambs for early puberty.

Ram Management and Breeding Records

Shear the rams six to eight weeks before the breeding season if you expect maximum breeding results. Rams in long fleece during hot weather may become infertile because of high body temperatures, and

may take six weeks or longer to regain their fertility. Some flock owners have improved breeding performance and their lamb crops by turning rams in with the ewes only at night and keeping the rams in cool quarters during the day.

Scrotal circumference should be measured at least two months before the breeding season and then again just before turning the ram in with the ewes. If the second measurement is smaller than the first by five centimeters or more, the ram is quite likely to be sterile. Normal fertility will not be realized until the scrotal circumference returns to normal. This measuring procedure should be used regularly before breeding, regardless of season.

New rams should not be turned in with the ewes as soon as they arrive at the farm but should be allowed at least one or two weeks to become familiar with their new environment. The same is also true of show rams. Gradually lower the condition of these rams and give them plenty of exercise for several weeks before turning them in with the ewes.

It is advisable to use some system of marking so you will know when the ewes are bred and whether the ram is doing an effective job. A marking harness with crayons can be used for the ram, or his brisket can be smeared with a marking pigment. In either case,



The use of a marking harness is a very satisfactory means of determining when the ewes are being bred and whether or not the ram is doing an effective job. Notice the proper position of the harness as shown here and the fact that the ram has been shorn before the breeding season.

whenever a ewe is bred, her rump will be marked. Change the color of the marking crayon or the brisket smear pigment every 14 days. For the smear pigment, you can use yellow ochre and old crankcase oil, venetian red and crankcase oil, lamp black, or paint pigment and axle grease. Apply it to the brisket every second or third day.

It will be easier to keep an accurate breeding record if you paint brand the ewes and record breeding marks. Use any good, scourable paint-branding fluid. The ewes can be paint branded in several places such as the side, back, or shoulder; the back is most commonly used. In this way when a ewe is marked by the ram she can be easily and quickly identified.

Close observation during the breeding season is essential so you know whether the ram is serving the ewes normally and whether a high percentage are being settled on first service. If a high percentage of the ewes have not been settled after two heat periods, the ram should be replaced.

Effects of Light, Temperature, and Relative Humidity on Reproductive Performance¹

Light, temperature, and possibly relative humidity affect the season when ewes will exhibit estrus, the relative ovulation rate, and embryo survival. Since there is some interaction among these three factors, they must be considered together.

Sexual activity in sheep is primarily controlled by the light-dark ratio. The incidence of estrus increases as the days become shorter. Because of individual and breed differences, breeding activity occurs in all months of the year, but fertility is generally the highest and most efficient in September, October, and November, when light exposure is 10 to 12 hours. In many parts of the United States, cooler temperatures are common during this period, making embryo survival more probable. Ovulation rate and lamb production do change with the season (Table 6).

Similar differences might be expected in ovulation rate among fine-wool ewes in other sections of the United States. The lamb production pattern might differ with variations in temperature during the breeding season. Ovulation rate in the yearling ewe has been found to be related

¹This section and Table 6 are adapted from *The Sheepman's Production Handbook*.

Table 6. Performance of Rambouillet Ewes Bred During Four Different Seasons in Texas

	Breeding intervals			
	Mar. 21- May 2	June 21- Aug. 2	Sept. 21- Nov. 2	Dec. 21- Jan. 1
	<i>percent</i>			
Ovulation rate	106	141	175	152
Lamb production	84	97	127	135 ^a

^a Higher lamb production in December is believed to be due to better embryo survival at cooler temperatures.

to subsequent lamb production. Under some conditions, ovulation rate observed by means of the laparoscopy technique in yearling ewes could be used as a method of selecting for increased fertility.

Temperature has a marked effect on fertility, embryo survival, and fetal development. Experiments show that air temperatures higher than 100°F for periods of three months or longer almost eliminate reproduction in sheep. Constant temperatures of 90°F reduced fertility by 50 percent, with no embryo survival. In ewes exposed to a continuous 90°F temperature on the day of breeding, none of the embryos survived. Seventy percent of the embryos were lost if the ewes were exposed to this temperature one day after breeding. Exposure to heat three, five, and eight days after breeding had progressively less effect on embryo survival. Very little embryo loss occurred later than 25 days after mating.

These results were obtained when the relative humidity was constant at 60 to 65 percent. Heat stress with much lower relative humidity may not be as harmful. Temperatures of 90°F for short periods of time (four hours) may not greatly reduce fertility or survival rate. Heat stress during gestation also has an adverse effect on fetal development, resulting in significantly smaller lambs at birth.

The ewe's activeness may affect her body temperature and fertility. Ewes required to walk long distances for feed and water during hot weather may show an increase in body temperature that will be detrimental to reproductive efficiency. Overeating in extremely warm weather also may increase body temperature. Excessively fat ewes are more susceptible to heat stress than ewes in moderate breeding condition.

Most range sheep producers in the northern half of the United States do not need to control light and temperature. When producers in the southern portion of the United States mate their ewes between September and December, they should provide as much shade as possible and limit the ewes' exposure to direct sunlight as much as is economically feasible.

Ewes in farm flocks may be sheared, kept in cool buildings or shaded areas during the day, and pastured only at night in an attempt to reduce heat stress. In range flocks, where ewes cannot be housed or shaded during the day, they should not be sheared. Body temperature in direct sunlight will be lower in sheep with one to two inches of wool than in freshly shorn sheep, as the fleece acts as an insulator against both heat and cold.

Sheep Health Management

Maintaining a healthy flock and minimizing disease should be the goal of every shepherd. This goal can be accomplished by a combination of superior nutrition, timely management, and appropriate health practices.

The best economic returns are realized when disease problems are at a minimum. Because the symptoms of some diseases are so similar (i.e., white muscle disease, polyarthritis, tetanus), you need to work closely with a veterinarian specifically interested in sheep. Do-it-yourself health programs can lead to disaster. The most important thing the veterinarian can provide is a diagnosis or the means of obtaining a diagnosis when a disease occurs. The veterinarian should also be familiar with current regulations and health requirements for shipping animals.

Only after a diagnosis is made can reasonable, rational treatment begin. The earlier effective treatment is begun, the better the chance for a recovery.

An important aspect of diagnosis is the postmortem of animals that were terminally ill. Proper laboratory samples should be submitted by the veterinarian to a diagnostic laboratory. Diseases might have more than one cause or overlapping causes. Sometimes diseases occur simultaneously. Interrelated causes and some of the diseases they are associated with are given on the next page.

Improper nutrition, including incorrect supplementation. This can cause (a) pregnancy toxemia; (b) copper toxicosis; (c) white muscle disease; (d) urinary calculi; (e) overeating diseases such as enterotoxemia type D, grain overload or lactic acidosis, founder or laminitis, and sawdust livers (abscesses).

Parasites. These are classified as internal and external. Internal parasites are as follows: gastro-intestinal roundworms, tapeworms, liver flukes, coccidiosis, and nose bots. External parasites include keds (sheep ticks), lice, mange mites, and maggots.

Infectious diseases. Many contagious or infectious diseases or both can be prevented by proper immunization. Timing is important, and most immunizations require a booster two to four weeks after the first injection. An annual booster is usually needed for continued immunity and for protection of the unborn lambs.

A vaccination program is effective only if the flock is healthy, well fed, and free from stress. Vaccinating sick, parasite-ridden, or poorly fed sheep is not likely to be effective.

To protect your sheep flock from disease, some minimal handling facilities should be available. Chutes and headgates allow for more comfortable working conditions. If health maintenance procedures are difficult or tiresome, they will be avoided. These procedures must be repeated regularly.

One often neglected consideration is the provision of an isolation area. New purchases, sick animals, and those returning from sales and shows need to be kept completely separate from the rest of the flock for two to four weeks. This is one of the simplest and most effective means of preventing the spread of disease.

It is not always possible to anticipate certain stress problems such as sudden weather changes, an attack by dogs, or a drought that affects feed supplies. However, it is possible to anticipate many of your health problems that arise from (1) infectious diseases; (2) internal and external parasites; and (3) known soil or feed deficiencies.

Vaccinate only for diseases that are a potential problem in your area. The best prevention is to avoid contact with diseased animals. It is essential to cull those animals that are chronically weak or sickly. Try to plan flock replacements so that you have time to immunize them, deworm them, run them through a foot bath, and isolate them for three to four weeks before introducing them to the main flock.

The sheep health management calendar on the following pages will help you develop your sheep management program.

Health Management Calendar

Sixty Days Before Breeding

Shear the ram, deworm, trim his feet, protect from heat stress.

Measure scrotal circumference of all stud rams.

Thirty Days Before Breeding

Vaccinate ewes (if a problem is present) against:

- Vibrio
- Chlamydia
- Leptospirosis
- Soremouth

Deworm ewes and ram(s), including teaser rams.

Trim sheep's feet and run all sheep through a footbath.

Fourteen Days Before Breeding

Flush ewes by increasing their level of nutrition.

Turn in teaser ram with ewes.

Breeding Time

Remove teaser ram.

Put fertile ram with ewes, using marking harness or brisket smear.

Measure scrotal circumference of stud rams and compare measurements with those taken two months earlier.

Sixty to Ninety Days After Ram Is Turned In

Give all ewes a vibrio booster.

Thirty Days Before Lambing

Shear ewes if you can provide adequate protection from cold weather.

Deworm all ewes and rams. Read labels carefully, because not all deworming agents can be used for ewes in late pregnancy.

Inject ewes with a combination of vitamin E and selenium unless a selenium-fortified supplement is being provided.

Thirty Days Before Lambing — *continued*

Begin to feed grain in addition to roughage, starting 30 to 40 days before lambing, and work ewes up to $\frac{3}{4}$ to 1 pound of grain per head per day.

Vaccinate pregnant ewes with:

- Clostridium CD toxoid
- Tetanus toxoid
- Pasteurella bacterin. Repeat pasteurella bacterin every two weeks until the ewe lambs.

Treat ewes for coccidiosis if this had been a problem.

Clean barns to bare ground, then use a limestone base and cover with fresh bedding.

Ten Days Before You Expect Lambing to Begin

Set up lambing pens and lambing cubicles.

Check equipment and medical supplies. These should include the following: stomach tube, plastic bucket, paper towels, surgical soap, delivery equipment, 7 percent iodine, tools for castration and docking, tetanus antitoxin, clostridium CD antitoxin, injectable vitamin E and selenium, heat lamps, and disposable needles and syringes.

Be sure everything is on hand, including milk replacer.

Sort out those ewes that will lamb early in the lambing season.

Refrigerate drugs.

Lambing Time

Place ewe and lambs in lambing pen after lambing.

Check udder and be sure teats are open — wash with soap and water.

Make sure that lambs nurse. It is important that the lambs receive colostrum.

Apply iodine to navels of lambs.

Give lambs clostridium CD antitoxin, if the ewes were not vaccinated, and inject lambs with Vitamin E and selenium.

Check for turned-under eyelids.

Use heat lamp, if needed, to dry lambs off, but do not overuse.

Lambing Time — *continued*

Start production records (put information on barn record, weigh lambs, tag, tattoo, or ear-notch lambs).

Leave animals in lambing pens one to three days, depending on the strength of the lambs and how well the ewe mothers them.

Dock lambs when they are removed from the lambing pens (give tetanus antitoxin).

Make a decision about castrating male lambs. If you decide to do so, castrate them at docking time.

Vaccinate inside elbow on bare skin at docking time if soremouth has been a problem.

One Week After Lambing Begins

Set up the creep close to the place where the sheep normally travel. In the creep you should:

- Use a high protein, palatable ration
- Place a light over the creep
- Provide bright, leafy legume hay in the creep
- Keep the creep area well bedded
- Make several openings for the lambs to go in and out of the creep
- Protect feeders so lambs cannot get their feet in the feeders

Prevent fecal contamination of feed and water to avoid parasites, especially coccidia.

Thirty Days After Lambing

Vaccinate lambs 30 days old with clostridium CD toxoid.

Give a booster shot two to four weeks later. (This booster should be given before weaning.)

Deworm ewes and rams.

One Week Before Weaning

Sort out the ewes that you plan to wean lambs from in a week and remove grain and protein supplement from the ration. OR

Limit nurse the lambs for the week before weaning, possibly allowing lambs to nurse only two or three times a day.

Sixty Days After Lambing

Wean lambs that are approximately 60 days old.

Leave ewes on roughage, allowing no grain until udders are dried up.

Allow time to flush the ewes before turning them with the ram for spring breeding.

Weigh lambs at weaning time and record.

Keep lambs on full feed until they reach market weight.

Sort lambs and sell when they reach market weight to prevent them from getting too fat.

Two Weeks Before Going to Pasture

Deworm ewes, rams, and all lambs that you plan to keep for replacement or sell as breeding stock.

Trim sheep's feet and run all sheep through a footbath.

Miscellaneous Items

Consider breeding ewe lambs so that they will lamb between 12 and 15 months of age.

Dip spray or dust for external parasites after spring shearing.

Keep production data on your entire flock.

Measure periodically the scrotal circumference of the stud rams and ram lambs that you are keeping to sell as breeding rams.

Rotate pastures if possible.

Keep pastures soil tested, fertilized, limed, and seeded as necessary.

Clip pastures before weeds mature.

Keep a supply of clean, fresh water available at all times.

Develop an efficient sheep-handling unit for your farm.

Use any of these recommended footbath solutions:

- Copper sulfate, 10 to 20 percent solution (do not use on lactating ewes)
- Zinc sulfate, 10 percent solution (8 pounds in 10 gallons of water)
- Formalin, 5 to 10 percent solution

Common Sheep Diseases

The diseases that most commonly afflict sheep are given below. Immediately seek veterinary attention if you suspect that your sheep have any of these diseases.

Pneumonia

Pneumonia is common among lambs and may be caused by specific bacteria or a combination of viruses and bacteria. Stress due to high humidity, drafts, insufficient colostrum, overcrowding, and exposure to infectious organisms all increase the risk of pneumonia. Adult animals that are chronic carriers may contribute to the problem.

Sudden, rapid breathing, some coughing, and fairly rapid death occur. Postmortems and cultures help identify the specific cause.

Control. Clean the barn thoroughly before lambing, then use a limestone base and cover with fresh bedding. Shearing the ewes before lambing and (sometimes) adding sulfa drugs to their water or antibiotics to their feed can reduce the incidence of pneumonia. Sixty-five milligrams of Aureomycin per ewe per day for 30 days before lambing, continued until weaning, has been beneficial in some problem flocks. In other flocks a nasal spray of parainfluenza vaccine or pasteurella vaccine before lambing has helped.

Individual treatment depends on the causative agent in that specific flock. Pasteurella, cornyebacterium, chlamydia, and mycoplasm bacteria and the parainfluenza virus have all been identified as causative agents.

Lamb Scours

In lamb scours, diarrhea occurs, which often results in pneumonia and death. Humidity, nursing dirty udders, overcrowding, and a deep, wet manure pack are all contributing factors.

Dehydration, chiefly, causes death. Sometimes the scour-causing bacteria enter the lamb's system and joints so that the animal does poorly even if it recovers. Scours usually affect lambs up to two weeks old.

Control. Clean, dry, well-bedded pens with sufficient space are the best means of control. At lambing, it helps to wash the ewe's udders with soap and water before the lambs nurse. Prelambing shearing prevents lambs from sucking on dirty wool tags.

The early, adequate intake of fresh, clean colostrum is vital to reducing diarrhea among newborn lambs.

If severe outbreaks with death losses occur, postmortem examinations, cultures, and antibiotic sensitivity testing may be necessary to

determine the most effective treatment. Sick lambs should be isolated with their mothers. This will allow more efficient individual treatment. Ewes with lambs should be watched for the development of udder problems resulting from reduced nursing.

Clostridial Diseases

Tetanus, overeating diseases, and malignant edema are all diseases that can be effectively prevented by use of vaccines or antisera at the proper time. Vaccines are available that combine all the significant clostridial immunizations in one injection. Regular, annual boosters will maintain immunity. Although these diseases mostly affect lambs, they all can occur at any age if an animal is injured or overeats (especially grain).

Tetanus (Lockjaw)

Tetanus is a disease caused by *Clostridium tetani*, a common soil organism. The spore form may live for years and remain a constant disease threat on some farms. The disease organism enters the animal via a wound. Puncture wounds are particularly dangerous. Elastrator bands may also lead to tetanus. Dog bites and penetrating or slow-healing wounds that become infected are possible sources of infection.

The first signs of tetanus are stiffness in walking, which may be confused with white muscle disease in the early stages. Polyarthrititis, joint ill, and erysipelas may also resemble the early stages of tetanus.

Animals overrespond to stimuli. Noise or sudden light causes them to become rigid and to experience muscle spasms. The head, neck, and back as well as the rear legs become rigid. Lambs may fall and be unable to rise.

Symptoms appear 10 to 14 days after an injury or wound. Usually death occurs within 3 to 5 days. Death is due to starvation or suffocation resulting from muscle rigidity.

Treatment is rarely effective. At the College of Veterinary Medicine at the University of Illinois, a few recoveries have been noted when antitoxin has been administered directly into the spinal canal.

Control. Take the following preventive measures:

1. Use tetanus antitoxin after all injuries and surgical procedures. Generally, doses of 150 to 250 units per lamb and 250 to 500 units for adult animals have proved to be satisfactory.
2. Administer toxoid to all animals on an annual basis during the last 30 days of pregnancy. Initial vaccination requires two injections 30 to 45 days apart.

3. Use 7 percent iodine on docking and castration wounds.
4. Promptly attend to all wounds, cleansing thoroughly, and continue follow-up treatments until the wound is completely healed.

Overeating Diseases

Clostridium-E. Coli complex. Ohio researchers are finding a disease complex caused by *Cl. perfringens*, *E. Coli*, and a rotavirus. Lambs are affected when they are less than four days old. The disease occurs during severe weather stress when animals are confined.

All three organisms are needed to produce the disease. Vaccinating with CD toxoid three to six weeks before lambing, or using CD antitoxin on the lambs at birth should control the condition. If any one of the three causative agents is controlled, the disease will not occur. The *Cl. perfringens* is the easiest organism to control.

Enterotoxemia. In the midwestern United States, enterotoxemia caused by *Cl. perfringens* is a major problem. The two types most commonly found are (1) type C and (2) type D. Some researchers, however, are finding diseases associated with types A and B also.

1. Type C or hemorrhagic enterotoxemia is a disease of suckling lambs that are usually less than ten days old. The causative organism *Cl. perfringens* type C is commonly found in the soil and in the intestinal tract of sheep. The toxin produced destroys the lining of the gut wall, releasing blood. It is also absorbed into the system, causing acute toxemia and irritation of the central nervous tissue.

This disease most commonly results in the unexpected death of large, vigorous lambs. Early symptoms are seldom noticed. Prompt postmortems of dead lambs reveal typical lesions of the intestinal tract.

Control. Although treatment is not usually feasible, the following preventive measures can help. Immunizing pregnant ewes during the last 30 days of pregnancy results in high levels of antibody in the colostrum. This gives immediate protection to the lamb. Thorough washing of the ewes' udders and the caretaker's hands before lambs are helped to nurse is also important. BCD antitoxin can be given immediately to newborns to prevent or control an outbreak if the ewes' immunizations are not current.

2. Type D enterotoxemia or pulpy kidney disease causes sudden death among lambs over 30 days old. Yearlings and adults may also be affected, but symptoms develop more slowly.

Overconsumption of high-energy feeds, an abundant milk supply, and lush pastures may all be responsible for the development of the disease. *Cl. perfringens* type D is commonly found in the soil and the

digestive tract of most domestic farm animals. The toxin causes nerve injury and shock, resulting in death. The symptoms may include head pressing, grinding of teeth, staggering, and convulsions. In lambs, symptoms last less than 2 hours; they may last for 12 to 24 hours in adults. Most affected animals die.

An immediate postmortem is needed to identify the cause of death because there are other conditions that are similar, such as electrical shock, bloat, parasitism, anthrax, black leg, and plant poisoning.

Control. The animals rarely respond to treatment. They may respond to CD antitoxin given intravenously. Response, if it occurs, is usually seen within an hour.

Type D toxoid gives the highest level of prevention. Two doses are given at two- to four-week intervals, followed by an annual booster. Lambs are initially vaccinated at 30 days of age and given a booster in two weeks, before weaning. Replacements and show lambs should receive a third booster when they are six months old.

Sheep being fitted for shows and sales, and those allowed in grain stubble or cornstalk fields, should receive boosters annually.

Malignant Edema

In malignant edema a gas gangrene condition develops after injuries or surgical wounds. Lambing difficulties, dog bites, docking, and castration can all result in the illness, which may become chronic on individual farms.

Control. Prevention of this disease is more effective than treatment. Vaccinating problem flocks can be a successful means of control.

White Muscle Disease

Nutritional muscular dystrophy is a degenerative disease of the skeletal and cardiac muscles. It is commonly found in areas where soils are unable to provide crops with 0.1 ppm of selenium. Sometimes excessive sulfur or nitrogen fertilizer can reduce the amount of selenium available in the soil.

A combined deficiency of selenium and Vitamin E results in the clinical disease. Lambs exhibit stiffness and rapid breathing; sudden death may sometimes occur from heart failure. Symptoms can resemble those of several other lamb diseases. Consequently, an autopsy is needed to determine precisely which condition is present.

Control. Prevention is again the most effective route to follow. Use only one method of control.

Feed supplementation of selenium at 0.1 ppm is now allowed by the Food and Drug Administration. Salt and mineral supplementation up to 30 ppm is allowed as an alternative.

A common method of prevention is to inject the lambs subcutaneously with selenium-Vitamin E at birth and again at 30 days of age. Supplemented rations will then carry the necessary amount of selenium for finishing the lambs to market.

Ewes may be injected with Vitamin E and selenium three to six weeks before lambing. Satisfactory amounts will be transferred to the unborn offspring and into the colostrum.

Urinary Calculi (Urolithiasis, Water Belly)

Male sheep on high concentrate rations are susceptible to urinary calculi. High-phosphorus diets or a calcium-phosphorus imbalance increase the chances of calculi being formed in the urinary tract.

Salts that are normally excreted precipitate because of their abnormally high concentration in the urine and thus form calculi or stones. These stones frequently lodge in the urethra, blocking the flow of urine. Cold weather, reduced salt intake, and reduced water intake all tend to aggravate this condition.

Affected animals stand around with arched backs, strain to urinate, and may kick at the belly or show other colicky symptoms. They also go off feed and water. In some cases the abdomen may become noticeably larger, or a swelling may develop along the underside.

Most animals die of uremic toxemia or peritonitis.

Control. Proper management is essential. Male lambs should be maintained separately from ewe lambs when on full feed.

A constant, clean, and fresh water supply needs to be available at all times. Maintaining the water supply at 45° to 50°F during cold weather will increase water consumption.

The addition of feeding-grade limestone at the 1 percent level will help counter the excess phosphorus in a high-concentrate ration. The ration should contain two parts calcium to one part phosphorus.

Ammonium chloride added to the concentrate ration at the rate of 0.5 percent (10 pounds per ton) will provide control, although it may reduce the palatability of the diet. It may then be necessary to grind the ration and add molasses to improve the taste.

Amputation of the urethral process helps if the blockage occurs there. Early surgical correction by a veterinarian can be effective. *Early action is crucial.* The condition itself is an emergency. To be resolved satisfactorily, it must be handled as such.

Mastitis

Mastitis is an infection of the udder, caused by bacteria. Trauma, wounds, soremouth lesions, and improper feeding can predispose ewes to the infection. Mastitis most commonly occurs close to lambing times or weaning.

The first sign may be lameness or refusal to allow lambs to nurse because of udder soreness. Ewes should be immediately isolated and lambs removed and fed artificially.

Control. Moist hot packs and frequent milking into a container reduce discomfort. Do not strip mastitic milk out into the bedding. Large, frequent doses of systemic antibiotics are necessary, and intramammary medication may be helpful. Milk letdown hormones can be used. Milk cultures should be taken before any antibiotic treatment is started. Your veterinarian can obtain the samples and make specific recommendations for treatment.

Avoid overcrowding, soremouth in lambs, and troughs or door sills that may injure udders. Feed ewes so they milk well so that lambs do not have to nurse continually. Prelambing shearing allows better observation of udders and earlier detection of problems.

Some areas report good results from using mixed pasteurized bacterin four to six weeks before lambing, and then monthly until weaning. Adding antibiotics to the grain or sulfas to the drinking water of the ewes has also proved effective in some problem flocks.

Pregnancy Toxemia (Ketosis)

Ketosis is a metabolic disease of pregnant ewes that occurs during the last six weeks of pregnancy. It is caused by the rapid growth of the fetuses and the ewe's decreased capacity for feed intake.

The ewe becomes sluggish and her appetite decreases, which worsens the problem. Nervous symptoms may develop, and the ewe acts blind, staggers, and grinds her teeth.

Control. Treatment is effective if initiated in the very earliest stages. Oral propylene glycol at two ounces, three to four times daily, provides a concentrated source of energy. Inducing birth is the most effective treatment. The use of molasses or other sugar sources is not recommended and may actually worsen the condition.

Veterinarians sometimes use corticosteroids to increase carbohydrate metabolism and also to induce lambing. In valuable animals a caesarian section may be considered.

Prevention is best accomplished by supplying an adequate energy source to pregnant ewes during the last four to six weeks of pregnancy. (Check nutritional requirements and suggestions elsewhere in this publication.)

Avoid any physical stress, sudden changes of feed, or activities that will alter feed requirements during pregnancy.

Contagious Ecthyma (Soremouth)

Contagious ecthyma is a highly contagious, acute dermatitis caused by a pox virus that produces pustules and elevated scabs on the face, lips, ears, genitals, and feet. Lesions may also occur inside the mouth and extend into the throat and down into the rumen. This disease is very widespread and causes particular problems in show animals. Its common name, soremouth, is highly descriptive.

The viral lesions frequently become contaminated with bacteria so that healing is delayed. Secondary bacterial infection, by invading the sheep's liver and lungs, also causes other serious side effects. Lesions may last two to three weeks. The extent of the lesions determines the seriousness of the problem. Lesions usually become more extensive as the disease progresses through a flock. Consult a veterinarian to differentiate soremouth from several other conditions that have similar symptoms.

The most serious problem is the loss of udders among ewes that develop mastitis, a condition caused by nursing lambs with soremouth lesions. Death losses are usually low. Economic loss may be considerable because of the unthriftiness of affected animals. Animals showing lesions are also barred from the ring.

The disease occurs primarily among newborn lambs and lambs of feedlot age, producing immunity in the survivors. It frequently appears 7 to 10 days after sheep come home from a show or sale.

Control. Prevention is best accomplished by using a commercially available live vaccine. Vaccinate the animal in an area of the body that is wool-free. Avoid skin disinfectants and wear rubber gloves when handling the vaccine.

If you anticipate that the flock will be exposed to soremouth or if exposure has occurred, vaccinate the sheep. Initially, the entire flock should be vaccinated. Vaccination appears to be effective for up to three years. Replacement ewes should be revaccinated before breeding even if they were immunized as lambs. Since the colostral protection

carried over to the lamb is considered minimal, lambs should be vaccinated within the first week of life.

Treatment consists of providing soft feed, fresh water, and nursing care. Topical individual treatment is seldom feasible, but in valuable animals, it may be warranted. Broad spectrum antibiotic ointments that soften and destroy secondary bacteria should be used. When treating lesions, wear rubber gloves and handle the animal carefully.

The virus is very resistant to drying. Premises that have housed soremouth sheep should be considered infected indefinitely.

Feeding the Stud Ram

Even though very little research work has been done on the nutrition of the stud ram, some general recommendations can be made. The stud ram, like the brood ewe, requires adequate nutrition in order to perform efficiently. Poor nutrition can result in lowered fertility or even infertility, as well as loss of vigor and strength. For best results the ram should be in moderate condition at breeding time.

In the summer and just before the breeding season, the ram can receive all of his nutrient requirements from pasture. If the ram begins to lose weight during the breeding season or if he is thin before the breeding season, he should receive from 1 to 1½ pounds per day of shelled corn or a concentrate mixture similar to that recommended for ewes. If a ram lamb is being used, he should be fed more than this amount.

During the winter months, feed the ram so that he gains some weight but does not become excessively fat. One and a half pounds of a concentrate mixture and 3½ pounds of legume or mixed hay per day should be enough for a 200-pound ram. Feed a 265-pound ram the same level of concentrate and 4 pounds of hay per day. When silage is fed, substitute 2 to 3 pounds of silage for each pound of hay replaced.

Ewe Nutrition

Providing adequate nutrition for the ewe flock throughout the year is a very important aspect of total flock management and one that is often overlooked. The fact that feed costs make up more than half of the total cost of production is a good reason why the nutrition program should receive close scrutiny. Shepherds must be alert to the changing

nutritional needs of their ewes. The following factors are among those that should be considered in determining the nutritional needs of a ewe:

- Age
- Size
- Condition
- Amount of confinement
- Stage of production (maintenance, pregnancy, or lactation)
- If pregnant, in which third of pregnancy is she, and how many fetuses is she carrying?
- If lactating, how many lambs is she nursing, how far along in lactation is she and how soon will her lambs be weaned?
- Is the ewe on an accelerated lambing program or is she lambing just once a year?
- Quality of the feedstuffs available and the form in which they will be fed
- Health status of the ewe
- Season of the year
- Other environmental factors (such as shearing in cold weather)



Adequate nutrition is essential to ensure strong lambs at birth and heavy-milking ewes.

In developing a feeding program for your ewe flock, take advantage of its ability to efficiently use large quantities of roughage and pasture. A sound feeding program should include maximum use of high-quality hay (legume or mixed), silage (corn, grass, or legume), or haylage. *Silage for sheep should be chopped more finely than for cattle in order to minimize spoilage and obtain the most efficient utilization.*

Two of the most critical periods of the year, so far as nutrition is concerned, are late pregnancy and early lactation. If a ewe is expected to deliver large, strong, healthy lambs and produce a heavy flow of milk, adequate nutrition must be provided before and after lambing. Trace-mineralized salt or a salt-mineral mixture should be fed free choice throughout the year. In areas where copper toxicity is a problem, use trace-mineralized salt that is devoid of copper. If you are in a selenium-deficient area, then you should use a salt mixture that is supplemented with selenium.

Sheep should have plenty of clean, fresh water available at all times. During cold weather, keep water from freezing so that water intake is adequate.

Concentrate Mixtures

The concentrate mixture can be very simple. Make maximum use of homegrown grains. If a high-quality legume hay or haylage is fed, no protein supplement is needed for gestation or lactation; however, lactating ewes nursing three or more lambs will need supplemental protein. Corn, oats, and barley are excellent cereal grains for feeding sheep, and the combination of any two or all three can make up the concentrate mixture. A commonly used mixture is a combination of half oats and half shelled corn. Shelled corn alone will work satisfactorily and is often the cheapest source of energy. The total digestible nutrient (TDN) value of corn is approximately 80 percent and of oats approximately 68 percent.

Sometimes bran is used to make up 10 percent of the mixture, primarily because of its laxative properties. When poor-quality hay or haylage is fed, or when corn silage is fed, a protein supplement must be included.

Another important item to consider in determining the ratio of hay to grain is the cost of hay in relation to the cost of shelled corn. When hay is high-priced and shelled corn is low, it may be more economical to cut down on the amount of hay fed and to increase the amount of shelled corn being fed. A good rule of thumb is that 0.7 pound of a mixture containing two parts corn and one part soybean meal (44 percent protein) is approximately equal to 1 pound of high-quality

alfalfa hay in both TDN and crude protein. Since shelled corn contains approximately 80 percent TDN and alfalfa hay 50 percent TDN, a pound of shelled corn contains 1.6 times as much energy as a pound of alfalfa hay.

Flushing the Ewes

Feeding a ewe so that it rapidly improves in condition from ten days to two weeks before breeding (commonly known as flushing) may increase the lambing percentage by 10 to 20 percent. This increase will not be as great if ewes are already in a high condition before breeding. Ewes that become too fat may not breed at all. To flush ewes, let them graze better pasture or feed them 0.50 to 0.75 pound of corn or oats or a mixture of the two per head per day. Use some caution if you flush ewes by turning them onto lush legume pastures; during years of heavy rainfall, such pastures may contain a high level of coumestrol, a plant estrogen that can delay conception.

Feeding During Gestation

Whether you should give ewes supplemental feed during early pregnancy depends on the availability of feed in the form of pasture, stubble fields, and stalk fields. If the roughage supply in the fields is not adequate and the ewes are not at least maintaining their weight, feed one or two pounds of legume hay per head per day.

Feed a concentrate ration during the last four to six weeks of pregnancy to provide an additional supply of energy to meet the demands of the rapidly developing fetus. About two-thirds of the birth weight of a developing fetus is gained during the last six weeks of pregnancy. It is usually believed that a ewe should gain from 20 to 30 pounds during pregnancy.

Inadequate nutrition during the last six weeks of pregnancy may result in the following:

- A higher percentage of ewes with pregnancy disease
- A decrease in birth weights
- Weaker lambs at birth
- An increase in infant lamb mortality
- Lambs that gain more slowly
- Lower milk yields during lactation

The information in Table 7 will help you determine how much feed your ewes will need in late pregnancy. Several different roughages are

listed in combination with shelled corn. Remember that the amounts of feed listed in Table 7 are for ewes of two different weights, so pick the column that best fits your situation.

The exact amount to feed depends on the weight and condition of the ewes. Silage can be substituted for hay at the approximate rate of 2½ to 3 pounds of silage for each pound of hay replaced, depending, of course, on the moisture content of the silage. Keep in mind that corn silage is low in protein and calcium, so a protein-mineral supplement must be added unless half your roughage is legume hay.

Researchers at the Ohio Agricultural Research and Development Center have had excellent results from feeding a treated corn silage that is a complete diet for ewes during gestation as well as for ewes nursing single lambs. *Ewes nursing twins are supplemented with ⅔ pound of soybean meal per head per day (or a comparable preformed protein source) for the first four weeks after lambing; the quantity is then decreased.*

Table 7. Daily Feed Consumption Needed to Meet Nutrient Requirements^a When Shelled Corn and Various Roughages Are Fed to Ewes in Late Pregnancy

Feed combinations	Ewe weights ^b	
	130 lb	180 lb
	<i>pounds</i>	
Alfalfa hay	3.75	4.50
Shelled corn	0.75	0.75
Clover-timothy hay (50-50)	3.75	4.50
Shelled corn	0.75	0.75
Orchardgrass hay	4.00	4.75
Shelled corn	0.75	0.75
Alfalfa silage (30% DM)	6.50	9.00
Alfalfa hay	1.00	1.00
Shelled corn	1.00	1.00
Alfalfa haylage (50% DM)	6.50	8.00
Shelled corn	0.75	0.75
Corn silage (30% DM)	6.75	8.75
Alfalfa hay	1.00	1.00
Soybean meal	0.25	0.25
Shelled corn	0.50	0.50

^a Assuming that a salt-mineral mixture is fed free choice.

^b Weights at breeding time with ewes in average condition.

Researchers advocate that the silage should contain 32 to 38 percent dry matter and should be chopped fine. The additions per ton of silage (added at ensiling time) consist of the following:

- 15 pounds of urea
- 10 pounds of limestone
- 4 pounds of dicalcium phosphate
- Equivalent of 1 pound of pure sulfur

Even fall-lambing ewes on good pasture should receive from ½ to 1 pound of grain per head per day during the last four weeks of pregnancy.

Self-Feeding Brood Ewes

In recent years, producers have shown increased interest in self-feeding complete ground mixed rations to pregnant and lactating ewes. The two main advantages of self-feeding a ground mixed ration are reduced labor in feeding and more efficient use of lower quality roughages. One of the major disadvantages of self-feeding has been that ewes could become too fat. However, research at the University of Illinois and other universities and research stations indicates that ewes can be satisfactorily self-fed. The consumption of a self-fed ration can be controlled by limiting the time the ewes have access to the self-feeders. A high percentage of roughage is used in self-fed rations.

Studies at the University of Illinois have used two self-fed rations that give satisfactory results (Table 8).

Table 8. Two Satisfactory Rations for Self-Feeding Ewes

Ingredients	Corncob ration			Oat hay ration		
	Early ges- tation	Late ges- tation	Lac- tation	Early ges- tation	Late ges- tation	Lac- tation
	<i>pounds</i>			<i>pounds</i>		
Corncobs, ground	70	65	60	...	...	...
Oat hay, ground ^a .....	...	...	...	80	75	70
Alfalfa meal.....	5	5	5	5	5	5
Corn, ground	10	15	20	10	15	20
Soybean meal	15	15	15	5	5	5
Steamed bone meal	1	1	1	1	1	1
Salt, trace-mineralized....	1	0.5	0.5	1	0.5	0.5

^a Medium- to low-quality hay can be used in a similar manner as the oat hay.

Table 9. Straw in a Self-Fed Ground Mixed Ration for Ewes

Ingredients	Late gestation	Lactation
	<i>percent</i>	
Straw	37.5	29.0
Legume hay (high-quality).....	37.5	29.0
Shelled corn	25.0	35.0
Soybean meal ^a .....	...	7.0

^a If ewes are nursing twins, increase the soybean meal to 13 percent and reduce each of the other ingredients by 2 percent.

A self-fed ration that has been used successfully at the Dixon Springs Agricultural Center consists of 34 percent ground ear corn and 66 percent ground grass-legume hay. Self-feeding this ration can begin a month before lambing and should extend for no more than 60 days after lambing. If you have a large number of multiple births, ground shelled corn can be substituted for ground ear corn. If high-quality legume hay is used, then a ration of 80 to 85 percent hay and 15 to 20 percent grain should work during late pregnancy. The grain portion could be increased to 20 to 25 percent after lambing.

Straw can also be used satisfactorily in a self-fed ration. The ration given in Table 9 has been used successfully by Illinois producers.

Self-fed ewes nursing twins will require a higher percentage of grain and a higher percent protein in the ration than self-fed ewes nursing only singles.

Use of Antibiotics in Ewe Rations

In a South Dakota study conducted from 1964 to 1966, pregnant ewes were supplemented with 60 milligrams of Aureomycin per head daily for 80 days, starting six weeks before lambing. Results show that lamb mortality was substantially reduced. The average lamb mortality rate from birth to weaning for the three-year period was 3.9 percent in the Aureomycin-supplemented group, compared with 14.5 percent in the control group. The antibiotic treatment did not influence weight changes among ewes or lamb gains from birth to weaning.

A study conducted at the University of Wyoming in 1979 and 1980 gave similar results. Supplementing pregnant ewes with 65 milligrams per head per day of Aureomycin, starting six weeks before lambing and concluding six weeks after the beginning of lambing reduced lamb deaths between birth and 14 days of age from 13.8 to 4.8 percent in

1979, and from 15.6 to 10.9 percent in 1980. An apparent improvement in general health was observed as well as a reduction in the incidence of mastitis and corynebacterium abscesses.

Feeding During Lactation

Lactation places a greater demand on the ewe than pregnancy and increases the need for higher nutrient levels (see Table 10). The difference between the protein requirement for ewes nursing singles or twins is 0.14 pound per day. Many researchers, however, now feel that the protein requirement for ewes nursing twins is much higher than indicated by the National Research Council, particularly during the first four weeks of lactation. Some researchers are now recommending that a ewe nursing twins should receive approximately 0.25 to 0.30 pound more protein per day during the first four weeks of lactation than a ewe nursing a single lamb.

A ewe reaches peak milk production about 4 weeks after lambing, after which time milk production begins to decrease. Weaning at 60 to 90 days is very common, but a few producers wean at 35 to 42 days.

During the first 60 days of the lactation period, you should feed according to the amounts recommended for small and large ewes nursing singles or twins (Table 11). Separate the ewes with twins from the ewes with singles and feed accordingly. Keep in mind that the actual amount fed depends on the weight and condition of the ewes and that the feeding value of 2½ to 3 pounds of silage is about the same as 1 pound of hay.

By the time lambs are between one and two months old, they will be eating quite a portion of the ewes' feed. Make sure to allow for this and increase rations so that the ewes' requirements are still met.

After the first 60 days of lactation, reduce the amount of feed to the amount the ewes were being fed during late pregnancy. Additional feed at this time will only fatten the ewes unnecessarily and increase the cost of production.

Research at the Ohio Agricultural Research and Development Center has produced some very important guidelines for feeding ewes that are nursing triplets. These guidelines are as follows:

1. Ensure that ewes are in above-average condition at lambing time.
2. Include 16 to 17 percent *crude protein* in the total diet during the *first four weeks of lactation*.
3. Limit roughage in the diet to 2 to 2½ pounds of high-quality legume roughage per day.

Table 10. Changes in the Daily Total Digestible Nutrients (TDN) and Protein Requirements of a Ewe from Maintenance Through Early Lactation

Ewe weight	132 lb ^a		154 lb ^a		176 lb ^a		198 lb ^a	
	TDN	Protein	TDN	Protein	TDN	Protein	TDN	Protein
<i>Stage of production</i>								
Maintenance.....	1.34	0.22	1.45	0.24	1.59	0.26	1.71	0.28
Early pregnancy.....	1.59	0.26	1.70	0.28	1.81	0.30	1.92	0.32
Late pregnancy.....	2.42	0.39	2.69	0.42	2.82	0.45	2.95	0.48
Early lactation, single.....	3.30	0.53	3.59	0.57	3.72	0.60	3.85	0.63
Early lactation, twins.....	3.72	0.66	4.01	0.71	4.30	0.76	4.59	0.81
		0.78 ^b		0.83 ^b		0.88 ^b		0.93 ^b

^a Based on ewe weight at breeding time.

^b Some researchers now recommend that ewes nursing twins should receive 0.25 to 0.3 lb more crude protein per ewe per day for the first four weeks after lambing than for ewes nursing singles. This new recommendation is reflected in the second protein level listed for ewes nursing twins.

Table 11. Daily Feed Consumption Needed to Meet Nutrient Requirements^a When Shelled Corn and Various Roughages Are Fed to Ewes in Early Lactation

Feed combinations	Ewe weights ^b			
	Nursing twins		Nursing a single	
	180 lb	130 lb	180 lb	130 lb
	<i>pounds</i>			
Alfalfa hay	5.0	4.0	5.0	4.0
Shelled corn	2.25	2.0	1.5	1.5
Clover-timothy (50-50)	5.0	4.0	5.0	4.0
Soybean meal	0.1 ^c	0.1 ^c	0.0	0.0
Shelled corn	2.25	2.0	1.5	1.5
Orchardgrass hay	5.0	4.0	5.0	4.0
Soybean meal	0.2 ^c	0.2 ^c	0.1	0.1
Shelled corn	2.25	2.0	1.5	1.5
Alfalfa silage (30% DM).....	10.0	7.5	10.0	7.5
Alfalfa hay	1.5	1.5	1.5	1.5
Shelled corn	2.25	2.0	1.5	1.5
Alfalfa haylage (50% DM).....	8.5	7.0	8.5	7.0
Shelled corn	2.25	2.0	1.5	1.5
Corn silage (30% DM)	9.5	7.5	9.5	7.5
Alfalfa hay	1.5	1.5	1.0	1.0
Soybean meal	0.30 ^c	0.25 ^c	0.25	0.25
Shelled corn	1.75	1.50	1.25	1.25

^a Assuming that a salt-mineral mixture is fed free choice. If you are not feeding a sheep mineral preparation, then consider feeding a mixture of 50 percent trace mineral salt (preferably copper-free) and 50 percent di-calcium phosphate during lactation to ensure adequate phosphorus intake.

^b Weights at breeding time with ewes in average condition.

^c Some current research indicates that the protein requirement for ewes nursing twins may be higher than the level indicated by NRC. You may therefore want to increase the soybean meal in these three rations by 0.3 pound per ewe per day for the first four weeks of lactation.

4. Feed total concentrate levels (grain + protein supplement) of 3 to 3¾ pounds to medium-sized ewes (150 pounds) per head per day. In addition, feed the ewes twice a day.

When the price of hay is high in relation to the price of corn, and corn provides the cheapest source of energy, then sheep producers may want to adjust their rations accordingly and take advantage of the cheaper energy source. Research at the University of Minnesota

points out that high-grain rations can be used satisfactorily for lactating ewes (Table 12).

Five or six days before weaning, start feeding only roughage but no grain or protein supplement. In the last two days before weaning, limit the ewes' water consumption if possible. This will help to dry the ewes up more rapidly, force the lambs to eat more creep, wean the lambs with a minimum of stress, and minimize udder problems after weaning. Remember that it is better to remove the ewes from the lambs and leave the lambs in the same area than vice versa.

As soon as the ewes can be turned out to pasture full time, no additional roughage or grain will be needed, provided sufficient pasture is available — unless you are on an accelerated lambing program.

Guidelines for determining yearly feed needs and feed costs for a 155-pound ewe in average condition at breeding time are as follows:

- 7 months of pasture
- 700 pounds of high-quality legume or legume-grass hay
- 30 pounds of grain before lambing
- 90 to 135 pounds of grain and supplement for a 60-day lactation period (depending on the number of lambs nursed)



There is increasing interest in the use of nipple waterers for sheep.

Table 12. Effect of Level and Source of Energy on the Performance of Lactating Ewes^a

	High hay		Low hay	
	Low energy	High energy	Low energy	High energy
Days fed.....	56	56	56	56
Initial weight (lb).....	161.9	159.7	169.0	165.9
Weight changes (lb)	-17.4	-7.0	-19.4	-3.8
Daily intake (lb)				
Hay.....	4.0	4.0	2.0	2.0
Corn.....	1.0	2.0	2.0	3.0
TDN	2.8	3.6	2.6	3.4
Lamb data				
Initial age (days).....	3-5	3-5	3-5	3-5
Number of lambs.....	40	39	38	37
Initial weight (lb).....	12.5	12.3	13.4	13.2
ADG, first 40 days (lb) ^b	0.37	0.42	0.34	0.44

^a The two low-energy rations and the two high-energy rations were equalized for energy (TDN) but not for protein.

^b Average daily gain of lambs that nursed ewes on the high-energy rations was significantly higher ($P < 0.05$) than of lambs that nursed ewes on the low-energy rations.

To be a good shepherd you must use your eyes, your hands, and a scale, if one is available, to keep track of the changes in weight and condition of the ewes. By keeping up-to-date on the changes in your flock, you can alter your feeding program accordingly and make the best use of your feed resources.

Ewe Management During Gestation

Exercise

Pregnant ewes should have plenty of exercise. Some flock owners feed hay or grain some distance from the barn so the ewes will be forced to exercise. The last month of pregnancy may present the most problems. Ewes that are extremely fat or carrying twins or triplets may become very sluggish. Watch them carefully and force them to exercise. Many of these ewes will eat less than they should; they are the ones that may develop pregnancy disease (pregnancy toxemia or ketosis).

Preparing the Lambing Quarters

Prior to lambing, clean out the barn to the bare ground, then use a good limestone base and cover the ground with plenty of fresh bedding. Sheep do not need elaborate or expensive housing and equipment. Whether you are following an early- or late-lambing program will determine how tight and free from drafts the building should be. Lambs can tolerate considerable cold but very little draft. Lambing pens (5 feet by 5 feet or 4 feet by 6 feet) should be set up before the lambing season in a draft-free area of the barn. Approximately one lambing pen should be available for each 10 ewes in the flock. Cleanliness in the lambing pens is very important. Remove dirty bedding from each lambing pen and put in clean bedding after each ewe is removed and before another is penned. Even though the average length of gestation is 148 to 150 days, some ewes lamb a week early, so it pays to be prepared. In addition, some ewes may go three to five days longer than normal.

Research at the Dixon Springs Agricultural Center involving lambing cubicles shows great promise. Position the lambing cubicles (4 feet by 6 feet) inside the pen where you keep the ewes closest to lambing. Use a two-foot wide entry and a ten-inch board for a threshold to keep lambs inside. Cubicles should be located in the corners and along the wall farthest way from the shepherd's work area. If you know from experience that there are favorite lambing sites in your barn, place the cubicles in those areas.

At the Dixon Springs Agricultural Center, 40 to 45 percent of the mature ewes have lambed in the cubicles. The percentage is usually lower with yearling ewes. The cubicle system has been found to be effective in reducing mismothering and lamb stealing, in decreasing the incidence of lambs from multiple births wandering away from their mothers, and in producing a stronger maternal bond between the ewe and her lamb or lambs. It was also discovered that 62 percent of the ewes that used a cubicle one year used a cubicle the second year as well.

Shearing Before or After Lambing

Deciding when the ewe flock should be sheared is a major management decision and one that should not be taken lightly. Shearing pregnant ewes several weeks before lambing is a practice that has both advantages and disadvantages.



Shearing ahead of lambing is a sound management practice if you have adequate facilities.

Advantages

1. It is easier to spot ewes that are close to lambing and those with udder problems.
2. Very few, if any, ewes will lamb outside.
3. It is more sanitary and makes nursing easier for lambs.
4. The barn is drier and less bedding is required.
5. More ewes can be accommodated in a limited space.
6. Fleeces contain less dirt and manure.
7. Lamb mortality from birth to weaning is often lower.

Disadvantages

1. A good building is absolutely essential.
2. Sheep are harder to shear in cold weather.
3. Additional feed is required for sheared ewes during cold weather for the first week or two after shearing.
4. If ewes are sheared too near lambing time and are handled roughly, some lambs may be born prematurely.
5. Extremely cold weather may be too stressful for sheared ewes that are thin, particularly if they are old.

Crutching

If you do not shear ewes before they lamb, at least crutch them out. Crutching means to shear around the udder, between the legs, and around the dock. If wool covering on the face is extensive, shear the head also.

Ewe Management During Lambing and Lactation

Lambing time is a very critical period of the year, because at this time you can "make or break" the future productivity of your flock. The higher the percentage of lambs born alive and reared to marketing time, the greater the gross returns from the enterprise.

Suggestions for Lambing Time

1. Make use of lambing cubicles (see page 54).
2. Watch ewes closely and assist them if necessary.
3. Examine ewes that have been in hard labor for an hour without apparent progress. Thoroughly wash your hands and arms and the ewe's vulva before examination, and proceed gently. A lamb is in normal position when the head is between and slightly above the front feet. Difficult lambing may be caused by any of the following conditions:
 - a. The lamb is extra large, especially its head and shoulders.
 - b. The ewe has a small pelvic area.
 - c. The ewe fails to dilate.
 - d. The lamb comes backwards (breech birth).
 - e. One or both front legs are bent back.
 - f. The head is bent back.
 - g. The lamb comes hocks first.
 - h. If the ewe is carrying two lambs, their legs may become tangled; or, if the two lambs are side by side, the ewe may try to deliver both at the same time.
4. After the ewe lambs, place her and her lambs in a lambing pen.
5. Check the udder to see if colostrum is available, and check the teats to be sure they are open.
6. Be sure the ewe owns her lambs and allows them to nurse before you leave.

7. If lambs are weak, help them nurse or use a stomach tube to ensure adequate colostrum intake.
8. If it is extremely cold, provide a heat lamp for each lambing pen. However, use the lamp only long enough to get the lamb dry and off to a good start. Prolonged use of a heat lamp in the lambing pen may increase a lamb's susceptibility to pneumonia.
9. Ear-tag, ear-notch, or tattoo lambs and record information on your barn records.
10. Ewes with healthy single lambs can be removed from lambing pens after one day, and ewes with healthy twins after two days.

Value of Colostrum

The first milk the ewe produces after lambing is called colostrum. It differs a great deal in chemical composition and biological properties from the milk secreted several days after lambing. It is essential for lambs to get some colostrum as soon as possible after birth, because it provides energy, protein, vitamins, and minerals as well as antibodies that help lambs resist infection. Lambs are born with a low level of vitamin A. Colostrum, which is rich in vitamin A, is therefore essential to build up the lambs' vitamin A reserves. Ohio studies indicate that ewes delivering twins have approximately 46 percent more vitamin A in their colostrum than ewes delivering singles.

Some flock owners freeze the colostrum from ewes that deliver dead lambs or those that lose their lambs. They then use it for orphan lambs or for lambs from ewes that have no colostrum available soon after lambing.

Udder Problems

The need to keep the ewe's udder working well cannot be over-emphasized. Milk is the lamb's main food for at least the first 30 days. There is a close relationship between milk yield and lamb growth and development, especially during the first stage of lactation. The capacity of the offspring to consume milk is one of the principal factors governing the amount of milk produced by the dam. Ewes with twins produce about 50 percent more milk than comparable ewes with singles.

Sound, well-shaped udders are extremely important. Ewes with pendulous udders, extremely large teats, or hard spots in the udder should be watched carefully after lambing. Sometimes it is hard to get lambs started nursing on ewes with low-hanging udders, since their natural instinct is to go up under the flank. You may have to help lambs whose mother has extremely large teats (balloon teats). It may

take as long as a week for these teats to become small enough that the lambs can nurse without assistance. Ewes with these problems are good candidates for culling.

You may want to consider artificially rearing the lambs from problem ewes rather than take a chance of losing some lambs by leaving them with their mothers.

Observe ewes and lambs carefully throughout the lactation period to detect sickness or other disorders before these become major problems. One of the potential trouble spots is the udder. If it becomes injured or infected and the condition is not treated early, the ewe may lose the milk-producing ability of one or both sides of the udder.

Lambs can also injure the udder with their sharp teeth. If these injuries are not treated early, they may become so painful when the lambs nurse that the ewe will automatically wean them. Udder sores provide excellent avenues for harmful bacteria to enter the body. Keeping the barn well bedded will help cut down udder problems.

(For a discussion of mastitis see page 40.)

Helping Ewes Own Their Lambs

Persuading a ewe to claim her lamb or lambs can sometimes be very difficult. The problem is greater when ewes lamb for the first time than it is with older ewes. If you have trouble with a ewe two years in a row, it would be best to cull her.

Why does a ewe fail to claim her offspring? There is no clear-cut answer to this question. A ewe may disown one or all of her lambs for a variety of reasons. For example:

1. A ewe may deliver one lamb in one part of the barn and a second lamb in another part of the barn.
2. One of a set of twins may wander away from the mother before she has fully recovered from delivery.
3. The ewe may have a very painful udder because of swelling, caking, or infection.
4. The teats may be cut or chapped, causing the ewe a great deal of discomfort.
5. A ewe that has been in labor for a long time may not be interested in her lamb for quite a while after delivery.
6. Sometimes a ewe may run a high temperature for several days after lambing and not show much interest in her lambs.
7. Sometimes ewes that are very nervous and flighty may present problems.

8. Some young ewes lambing for the first time may be frightened by the lambs they have given birth to.

It takes a lot of patience to work effectively with a ewe that disowns her lamb. Keep in mind that it is much easier for the ewe to raise her lamb than for you to raise an orphan. There is no guaranteed method of getting a ewe to claim her offspring, but grafting crates or stanchions are being widely used with considerable success.

Feeding and Management of Lambs to Weaning

Lamb Mortality

Lamb survival and performance determine to a large extent how profitable a sheep enterprise will be. Lamb mortality studies show that 50 to 70 percent of lamb deaths occur in the first three to five days after birth, and 80 to 90 percent occur during the first month. These figures indicate that it is extremely important for each lamb to get a good start and that the first few days are critical. These studies also show that the four main causes of lamb losses are weak lambs, starvation, stillbirths, and pneumonia. Male lambs are reported to have a higher mortality rate than females, and twins have a higher mortality rate than singles. In many flocks, more deaths occur among lambs born in the second half of the lambing season.

Disinfecting the Navel

It is a good practice to disinfect the navel cord of all lambs soon after birth with 7 percent tincture of iodine or another good drying antiseptic to prevent navel ill (joint disease), which is caused by bacterial infection. The disease causes the leg joints to stiffen and swell. Sometimes the navel area also becomes infected.

Inverted Eyelids

If not corrected, inverted eyelids (entropion) can lead to total blindness. Sometimes lambs have this condition at birth; others may not be affected until they are one or two weeks old. Unless severe, the condition can usually be corrected by catching the lamb several times a day and working the eyelid outward. Use an eye ointment or powder to help eliminate infection caused by irritation. If the condition is severe and does not respond to this treatment, try one of these

remedies: use adhesive tape to hold the eyelid in place for several days; hold the eyelid back with metal clips (surgical type); clamp the excess fold of skin below the eyelash with a small burdizzo to hold the eyelid in proper position; or stitch a fold of skin in the lower lid to keep the eyelid from rolling under. Inverted eyelids are a heritable trait, and you should therefore discriminate severely against animals with this trait.

Docking

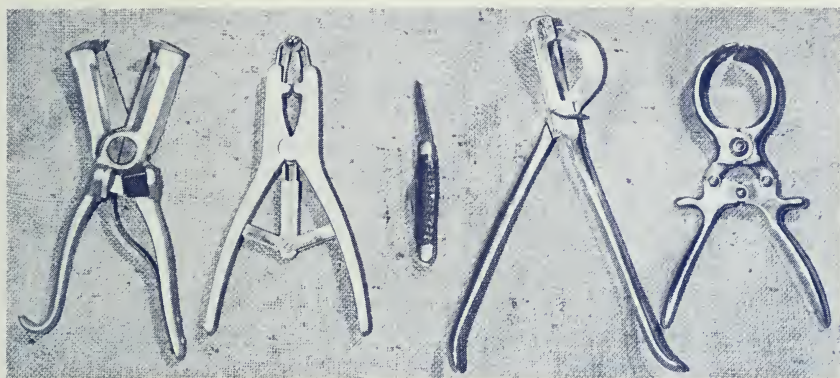
Lambs should be docked between three and ten days of age. Several pieces of equipment can be used for this job, including a pocketknife, burdizzo (emasculator), elastrator (rubber rings), emasculator, "all-in-one," and an electric docker. Cut off the tail 1 to 1½ inches from the body. A good place to cut is at the junction or end of the caudal folds on the underside of the tail. Try to push the skin on the tail toward the body before cutting to allow for enough loose skin to cover the stub and not expose the bone. Docking gives lambs a better appearance and decreases the chances of maggot infestation. Leaving tails on ewes can pose problems at breeding time and at lambing. (For a discussion of tetanus see pages 36 to 37.)

Castration

Early-born ram lambs that are to be fed for maximum growth and marketed under five months of age need not be castrated. Late-born ram lambs and ram lambs that will not be fed for maximum growth and will be over five months old when marketed should be castrated, preferably at an early age (two weeks or less). Normally, wether lambs will not gain as fast as ram lambs; however, one of the major problems with ram lambs is that they continually pester the rest of the sheep and may settle some of the ewes if left with them too long (five or six months). Wether lambs also usually have higher carcass grades and dressing percentages than ram lambs. Castration can be done with an elastrator, pocketknife, burdizzo, or "all-in-one." (For a discussion of tetanus see pages 36 to 37.)

Creep Feeding the Lambs

Creep feeding is a means of providing supplemental feed for the lambs during the nursing period. It is essential with an early-weaning program and, under conventional management, is usually more advantageous with an early-lambing program than with a late-lambing program. The advantages of creep feeding are that (1) it increases



The above equipment can be used for castrating and docking. From left to right: "all-in-one," elastrator (rubber rings), pocket knife, emasculator, and burdizzo (emasculatome). An electric docker can also be used for docking.

gains, especially for lambs from multiple births; (2) the lambs use supplemental feed more efficiently at this time than after weaning; (3) lambs can be marketed at a younger age; (4) earlier marketing usually means higher prices for lambs born early in the lambing period; and (5) early lambs can be sold without being put on pasture, thus permitting more ewes to be carried on available pasture and reducing internal parasite problems.

Lambs will begin to nibble at grain and hay very early and at least by the time they are a week old. However, they will not eat much supplemental feed until they are about four weeks old. Some guidelines to consider in constructing your creep are given below.

- Set up the creep when your first lambs are 7 to 10 days old.
- Put the creep in a convenient location close to the brood flock.
- Have openings on at least two sides of the creep.
- Have several openings on a side.
- Keep the creep area well bedded.
- Place a light over the creep area to help attract the lambs. Sunlight shining into a creep during the day will also attract lambs.
- Provide water in the creep or as close to it as possible. However, the water should be covered so the lambs cannot urinate or defecate in it. The water must be kept clean and fresh. The grain feeder should also be covered for the same reason.

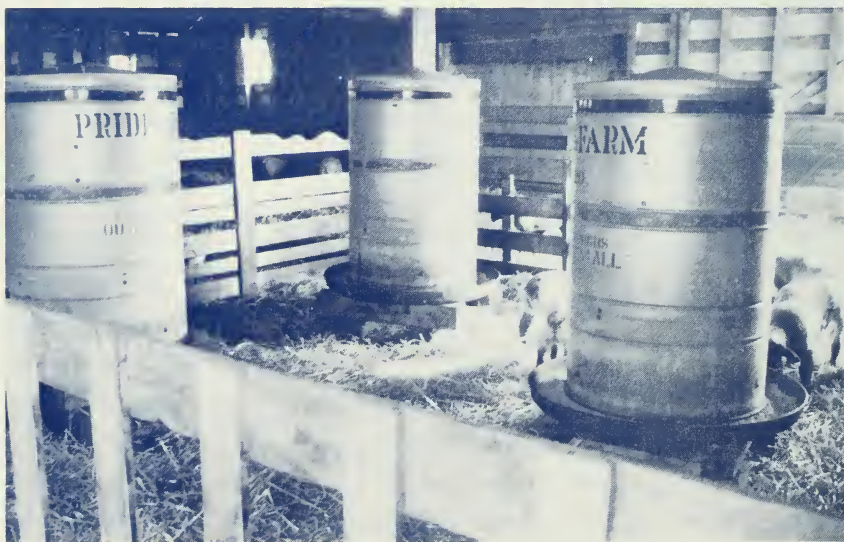
Make maximum use of home-grown grains and roughage when formulating the creep ration. Corn and oats as well as leafy, high-

quality legume hay make excellent feed for young lambs. Barley can also be used but may not be quite as palatable as corn and oats for the first couple of weeks.

Until the lambs are six weeks old, the grain used in the creep ration should be cracked, crimped, and rolled, unless fed as a pelleted ration. After the lambs are six weeks old, whole grain can be used unless it is extremely hard, in which case the grain should continue to be cracked, crimped, or rolled for several more weeks. Many people are using complete pelleted rations for creep feeding.

Although rolled oats are often too expensive to use, they are excellent in the creep ration or as a starter for lambs. Molasses is sometimes used in the creep ration, primarily as an appetizer and to hold down dust. If molasses is used, it should make up 5 percent — certainly no more than 10 percent — of the ration. Bran can also be used, making up 10 to 15 percent of the ration. Many people include bran in the creep ration because of its palatability and laxative properties.

The creep ration should contain approximately 16 percent crude protein, while rations for early-weaned lambs (under 60 days) should contain about 18 to 19 percent crude protein. High-quality legume hay may be self-fed in either the long or the pelleted form in addition to the concentrate mixture.



Creep areas need to be bright, well bedded, and roomy. They should have several openings on at least two sides and should be conveniently located.

Suggested creep rations that contain approximately 16 percent crude protein are given in Tables 13 and 14. Rations given in Table 13 apply to situations where hay is fed free choice; complete rations combining roughage and grain appear in Table 14. Linseed meal or other protein supplements can be used in place of soybean meal as long as you balance the ration so that it contains the desired protein level. If you plan to use a commercial protein supplement containing urea, wait until after weaning. This supplement (with urea) should be introduced gradually for best results. For optimum performance, have no more than 25 percent roughage in the complete ration.

It is usually recommended that antibiotics be included in the creep ration at the rate of 20 to 25 grams per ton, which is the equivalent of 10.0 to 12.5 milligrams per pound of feed. In some cases antibiotic levels twice that high have been beneficial. Aureomycin (chlortetracycline) and Terramycin (oxytetracycline) are the two most commonly used antibiotics in creep rations.

Creep rations do not have to be complex to be good. Research work in various states has indicated that lambs will perform as well on simple creep rations as on complex rations. However, there are times when a variety of ingredients or a change in ingredients may be beneficial if lambs go off feed. This problem is not as big with creep-fed lambs as it is with weaned lambs.

Table 13. Suggested Creep Rations with Hay Fed Free Choice^{a, b}

Ingredients	Approximate crude protein	Rations ^c				
		1	2	3	4	5
	<i>percent</i>			<i>percent</i>		
Shelled corn	8.8	79.5	41.5	41.5	41.5	35.0
Oats.....	11.5	...	41.0	...	...	35.0
Barley.....	11.5	...	...	41.0	...	...
Wheat (soft winter).....	11.5	...	...	...	41.0	...
Soybean meal.....	44.0	20.5	17.5	17.5	17.5	16.0
Wheat bran	13.5	...	...	...	...	14.0
Antibiotics.....	...	+	+	+	+	+

^a If molasses is used, it should not comprise more than 5 percent of the ration; at that level it can be substituted for any of the grain on a pound-for-pound basis.

^b If urinary calculi has been a problem, replace one pound of grain with one pound of feeding-grade limestone in each 100 pounds of feed. See also pages 39 to 40 for a discussion of urinary calculi.

^c Assuming that a salt-mineral mixture is fed free choice.

Table 14. Suggested Creep Rations with Hay Included at the 10 or 25 Percent Level^{a, b}

Ingredients	Approximate crude protein	Rations ^c					
		1	2	3	4	5	6
	<i>percent</i>			<i>percent</i>			
Shelled corn.....	8.8	69.5	57.0	68.5	55.0	67.5	52.5
Soybean meal.....	44.0	19.0	16.5	20.0	18.5	21.0	21.0
Alfalfa-hay, ground	15.0	10.0	25.0	...	...	...	...
Alfalfa-orchardgrass hay, ground	12.0	...	...	10.0	25.0	...	...
Orchardgrass hay, ground	9.0	...	...	...	...	10.0	25.0
Feeding-grade limestone .....	...	1.0	1.0	1.0	1.0	1.0	1.0
Trace-mineralized salt .....	...	0.5	0.5	0.5	0.5	0.5	0.5
Antibiotics .....	...	+	+	+	+	+	+

^a The rations with higher roughage levels are safer to use, although lamb gain and feed efficiency may be better on the low-roughage rations.

^b If substituting oats, barley, or wheat for part of the shelled corn, remove 1 pound of soybean meal (44 percent protein) for every 16 pounds of shelled corn replaced.

^c A salt-mineral mixture should not be fed free choice; however, iodized salt can be fed free choice.

Creep rations can be hand-fed or self-fed. Many sheep producers hand-feed until the lambs begin to eat regularly from the creep and self-feed from then until weaning or marketing. The creep feeder must be kept clean at all times to maximize consumption.

Differences in Individual Performance

The period of greatest difference in performance between single lambs and lambs of multiple birth is within the first 30 days, when the lambs are relying primarily on the ewe for their source of food. As lambs begin to eat supplemental feed, the differences in gain decrease, and somewhere between 60 to 90 days twins usually catch up with singles in the rate of gain (Table 15). Wether lambs usually gain at about the same rate as ewe lambs from birth to 90 days; ram lambs normally gain from five to ten pounds more during the same period.

Table 15. Performance Differences for Lambs According to Specific Period of Days After Birth

Item	No. of lambs	Average daily gain (lb) by period				
		0-10	10-30	30-60	60-90	0-90
All lambs.....	72	0.372	0.521	0.642	0.693	0.602
Singles.....	27	0.464	0.590	0.714	0.719	0.659
Twins raised single....	11	0.387	0.519	0.565	0.691	0.579
Twins raised twins.....	34	0.265	0.455	0.647	0.688	0.568

The “In-and-Out” System of Lamb Management

If lambs are not sold before going to pasture, the “in-and-out” system of lamb management may be practical. There are several alternative procedures in this system:

1. Keep ewes and lambs together in drylot at night, but place them on separate pastures during the day.
2. Keep ewes and lambs together in drylot during the day, but place them on separate pastures at night.
3. Keep ewes and lambs together in drylot at night, place ewes on pasture during the day, and keep lambs in the barn on creep feeders.
4. Keep ewes and lambs together in drylot during the day, place ewes on pasture at night, and keep lambs in the barn on creep feeders.

The “in-and-out” system tends to cut down internal parasite problems and improves lamb performance during the pasture season.

Weaning

The proper age to wean lambs depends primarily on the system of management. The following factors influence the age at which lambs are weaned: season of birth (early or late); percentage of multiple births; creep feeding; availability of grain or pasture; parasite problems; predators; type of sheep raised; and market prices and price outlook.

Most lambs in the midwestern states are weaned between two and four months of age, with two to three months being the most common range. Late lambs that reach market weight on pasture are usually weaned at an older age than early lambs that are creep fed. In recent years, the interest in earlier weaning has increased. One reason for

this is that milk production usually reaches a peak approximately four weeks after lambing and decreases thereafter. Three or four months after lambing, most ewes will be producing very little milk, and it would be more economical to wean the lambs and turn the ewes out to pasture or at least decrease their daily ration. Many flock owners now wean lambs at 60 days of age with good results, and some are weaning lambs successfully at younger ages. Successful early weaning depends upon how well the lambs are eating supplemental feed (creep) at the time they are weaned.

Feeding from Weaning to Market

One key to success, whether you are feeding an early-weaned lamb or a late-weaned lamb (which is very similar to a feeder lamb), is to use high-quality feeds and not change rations rapidly. Make any necessary changes in rations gradually by blending greater and greater proportions of the new feed with the old feed over a period of six to eight days. The ration of the early-weaned lamb should be high in digestible energy and fairly high in crude protein. For optimum performance, rations, if self-fed, should contain no more than 25 percent roughage (ground hay) and could contain as little as 10 percent. Although all-concentrate rations can be successfully self-fed, self-feeding should be done only when very careful management and close observation are possible. Poor management may result in a serious problem with overeating disease or enterotoxemia (see pages 37 to 38).

The protein needs of rapidly growing young lambs are best met by natural proteins (from corn, hay, soybean meal, and other feeds). The protein content of the ration should be approximately 16 percent. Although research indicates lamb gains will be greater on protein levels higher than 16 percent, it is often found that the cost of the additional protein is not paid for by the additional gain.

You can continue feeding the rations given in Tables 13 and 14 from weaning to marketing, or you can lower the protein content to 13 or 14 percent when the lambs reach approximately 85 to 90 pounds. How much you want to lower the protein content, if at all, will be determined by the lambs' frames and growth rates and the weight at which you plan to market them. The protein content of the ration can be lowered by about 1 percent for each 3 pounds of the grain mixture that you substitute for 3 pounds of soybean meal (44 percent crude protein) or for each $2\frac{3}{4}$ pounds of shelled corn you substitute for $2\frac{3}{4}$ pounds of soybean meal. The protein requirement for lambs close to market weight is less than for younger, more rapidly growing lambs.

What about replacing part of the natural protein with nonprotein nitrogen such as urea? Urea is most effectively used as a replacement for natural protein when lambs are within 25 pounds of market weight. It is likely that replacing natural protein with urea before this stage will not allow for optimum performance.

Take care to meet the mineral needs of weaned lambs. Calcium and phosphorus are essential minerals for bone formation but can cause urinary calculi (water belly) when not in the proper balance (ratio of Ca to P). The ratio of calcium to phosphorus should be at least 1½:1 and preferably closer to 2:1. (See pages 39 to 40 for further discussion of urinary calculi.)

Another important mineral is copper. Copper is an essential element for sheep; however, if it is at too high a level in the ration, it may accumulate in the liver and become toxic. In selecting trace mineral mixtures, be extremely careful that the levels of minerals (especially copper) in the finished feed do not exceed recommended levels. If copper toxicity has been a problem, then use a trace mineral preparation that is free of copper. You may also want to check the molybdenum level of your ration.

A good rule of thumb is that about 350 pounds of a high-concentrate ration (no more than 25 percent roughage) is required to produce a 110-pound market lamb, assuming that the lamb is creep fed and pushed hard from birth to market.

Developing Lambs into Yearlings

Ideally, yearlings should be well grown and in good condition but not excessively fat. Excessive finish is costly to put on and detrimental to reproductive performance.

What is the best way to develop lambs from market weight to yearlings? Different people have different ideas on the subject. Although some research information is available on the development of ewes, there is practically nothing on the development of rams. In fact, there is no ideal way to develop lambs into yearlings, one that will work for all sheep producers under all management conditions.

In determining what type of a feeding program to follow, you must answer several questions. "What is the genetic potential of my flock for yearling size? How hard do I want to push them? How much condition do I want on them? At what age do I want to use them for breeding purposes (both ewes and rams)?" And lastly, "Will I be entering some of them in shows or sales?" The development of lambs into yearlings is one of many areas of management where the "eye

of the master" is supreme. One must keep a close watch on the animals to know when to change the kind of ration, the amount being fed, or both.

Lambs that are to be bred and show lambs should continue to be well fed after they reach market weight. Lambs that will not be used for breeding purposes until they are yearlings can be developed more slowly after they reach market weight; however, they do need to be well fed over the winter so they will be well-developed yearlings that have adequate size in relation to their genetic potential.

Two items that should not be forgotten when growing out replacement animals are to keep the feet well trimmed and to follow a good parasite-control program. Internal parasites can greatly cut down on the performance of these young, growing animals.

When lambs are fed for maximum growth, some may have rectal prolapses. Those that do should not be kept for breeding purposes but should be marketed.

Research at the Dixon Springs Agricultural Center has indicated that large-framed ewe lambs that are to be bred to lamb at approximately one year can be self-fed a 50:50 hay-grain ration from market weight through lactation, with good results. If the hay is not high-quality legume hay, the ewes will need some additional protein during lactation, especially if they are nursing twins. This proportion of hay to grain can be altered to meet the needs of the individual breeder. Some may find that two-thirds roughage and one-third grain may work more satisfactorily, particularly if the ewe lambs are not being bred.

The National Research Council (NRC) requirements for an open ewe lamb weighing 110 pounds and gaining approximately 0.2 pound per day or weighing 132 pounds and gaining approximately 0.1 pound per day are 1.8 pounds of total digestible nutrients (TDN) and 0.29 pound of crude protein. Feeding 2 pounds of high-quality legume or legume-grass hay and 1 pound of shelled corn will meet the TDN requirements and provide more than adequate protein. If you want your ewe lambs to grow more rapidly than this, then increase the amount of feed. The shelled corn could be increased up to 1½ to 2 pounds per head per day or the shelled corn and hay could both be increased by a half-pound per head per day.

Ewe lambs that are to be bred should be managed and fed as a separate unit from the time they reach market weight until they are bred for their second lambing.

Research at the Dixon Springs Agricultural Center additionally indicates that good management and adequate nutrition during pregnancy and lactation are very essential for ewes that will lamb as yearlings. This work also revealed that flushing these ewes during

their second breeding season is very important. Ewes lambing in May (at 15 months of age) had little trouble nursing their lambs, but when they were turned on pasture in July, after lactation, they did not breed well in September. A short flushing period in which a half-pound of corn per day was fed proved to be very beneficial.

For fast-gaining rams, the 50:50 hay-grain ratio should work. However, if you prefer to develop your rams more slowly, then the $\frac{2}{3}$: $\frac{1}{3}$ hay-grain ration may be more satisfactory. In all cases keep a close watch over your animals so that the proportion of hay to grain is changed *before* the animals become too fat, not afterwards.

According to the NRC, a 176-pound ram gaining 0.33 pound per day or a 220-pound ram gaining 0.22 pound per day would require 3.39 pounds of TDN and 0.55 pound of protein per day. Feeding 4 pounds of high-quality legume hay or legume-grass hay and 2 pounds of shelled corn will provide slightly more than adequate TDN and protein. Three pounds of high-quality hay and 2½ pounds of shelled corn would also be adequate. If rams have the potential to gain more rapidly than this at the weights indicated and you want them to gain more rapidly, then obviously you will have to feed more per day or use a ration with a higher proportion of grain.

Artificial Rearing of Lambs

Extra or orphaned lambs appear in most flocks at lambing time. They are the result of ewe losses at lambing, rejection, or the production of multiple births beyond the ewe's nursing capability. It has been estimated that at least 10 percent of the nation's lamb crop dies from starvation during the first week after birth. The number will vary according to the health, age, and productivity of the ewe flock. Extra lambs can be reared, however, if good management is practiced.

Colostrum Feeding

Newborn lambs must receive colostrum milk or a substitute soon after birth or their chances of survival are poor. The colostrum can come from the mother or another ewe that has lambed about the same time. Collect colostrum by milking one side of the udder of good milking ewes with single lambs or ewes that have lost lambs within 24 hours of birth.

If ewe colostrum is not available, cow colostrum can be fed. The supply of colostrum can be frozen in paper cups or plastic bags (four to six ounces per container). When needed, it should be thawed and

fed at room temperature. Heating above normal body temperature may destroy antibodies. Feed four to six ounces of colostrum per head every 4 hours during the first 12 to 18 hours.

Various suggestions have been made on selecting the lamb or lambs to remove from the ewe. Remove small or weak lambs because they may not be able to compete when left with the ewe. If the lambs in a litter are equal, one practical method of selection is to offer the bottle to all of them. The lamb or lambs who take it the most easily will require the least labor when removed from the ewe.

Some shepherds find it beneficial to give lambs an injection of vitamin E-selenium compound. If lambs are to be housed on elevated slotted floors, they should also have an iron supplement in either oral or injectable form. This is usually given at the rate recommended for a baby pig. Some oral iron supplements contain copper and should be avoided. Selenium levels need to be adequate to prevent reactions to an iron injection.

Milk Replacer

Good commercial milk replacers designed for lambs are available and work well. These should contain 30 to 32 percent fat, 22 to 24 percent crude protein, and 22 to 25 percent lactose (dry matter basis). Calf milk replacers should only be used in an emergency and must be more concentrated than recommended for calves.

It is often suggested that the milk replacer is one of the most important factors contributing to success in rearing extra lambs. The milk replacer that gives good growth rate and lamb health with the least digestive disorders will prove to be the most economical.

Since a good lamb milk replacer is high in fat, it mixes more readily in warm water than in cold. Premix the powder with a small part of the water, making a paste, then add the rest of the water and mix well. Rapidly cooling the liquid mix to 33° to 40°F tends to reduce the problem of ingredient separation during storage or when in feeding containers.

Equipment

The number of lambs to be reared and the degree of automation desired will determine the type and amount of equipment used. The equipment should be simple to use, easily cleaned, and as inexpensive as possible. Lambs can be fed from a bottle if labor is available. They will need feeding to appetite about every 4 hours during the first week and then every 6 to 8 hours until weaned.

If several lambs are to be raised, some type of milk dispenser is essential to reduce labor. Several are available, including some with self-priming nipples. They are useful in training new lambs but are somewhat more difficult to clean. Dispensers with the nipple at the top will reduce milk wastage. Good sanitation is easier and digestive disorders generally are fewer if the milk is fed cold. Under most winter conditions the milk will not sour over a 24-hour period if transferred directly from the refrigerator to the milk dispenser. In warm weather the milk may be kept cold by placing plastic jugs full of ice in the feeding unit.

Under most conditions, the feeding unit should be cleaned well every day; however, some research workers have mixed 1 cc of formalin with each gallon of formula and report a sufficient reduction in bacterial and mold growth to reduce cleaning to once a week.

If lambs are to be raised on self-dispensing units, starve them for 8 to 12 hours after the last colostrum feeding, then introduce them to the unit with cold milk. A training pen should be set up where lambs are taught to use the dispenser. Lambs may need to be put on the nipples several times before they learn to nurse independently. When they can nurse independently, move them from the training pen to a self-sufficient pen. Leaving an older lamb who has learned to use the unit in the training pen will help the younger lambs to learn more rapidly. It is advisable to pen the lambs by age and to have a nipple available for each three to five lambs.

Housing

The lambs should be well protected from cold and drafts when being trained to use a milk dispenser; however, good ventilation is necessary. Pens should be kept dry and well bedded. An elevated slotted floor made with $\frac{3}{4}$ -inch wire mesh will be the easiest to keep clean and dry. In severe weather, heat lamps will be necessary in the training pen. Provide one lamp for each 10 to 12 lambs.

Creep feed should be offered to the lambs soon after they are started on liquid milk replacer. The physical form and palatability will influence consumption. Soybean meal is an excellent feed for the very young lamb. The starter creep feed should contain 17 to 20 percent protein. Lambs develop faster if they can consume a small amount of high-quality roughage such as alfalfa hay. Usually, lambs will take only small amounts of solid feeds during the period that milk is offered free choice. But having the solid feeds around will acquaint the lambs with dry feed and encourage development of the rumen, both of which are essential if lambs are to be weaned from milk replacer at 4 to 6 weeks.

Trace-mineralized salt and a clean water supply should be available at all times. After weaning, replace the trace-mineralized salt with plain salt. Water buckets, salt boxes, and feed troughs for dry feed should be located outside the pen so lambs have to reach through a panel to eat and drink. This will keep their feet out of the feeders and waterers, reducing contamination and the occurrence of digestive disorders.

Management on Pasture

Your sheep will get the most out of pastures if you do as follows:

1. Wait until pastures are ready before turning in the flock. Most forage should be 6 to 8 inches high before being grazed. Sorghum-sudangrass hybrids should be approximately 18 inches high before being grazed.
2. Use a moderate stocking rate to prevent close grazing. Stocking rates will vary with pasture forage used, season, and fertility level. If pastures become short because of drought or overstocking, wean all lambs that are old enough and put them on feed in drylot.
3. If possible, rotate pastures at two- to three-week intervals. Clip pastures at the end of each grazing period to encourage new growth, retain legumes in the pasture mixture, and control weeds. Grazing with cattle will increase pasture productivity, as measured by animal gains.
4. Provide clean water and shade.
5. Fertilize and lime pastures regularly for maximum production.

Parasite Control

External Parasites

The presence of external parasites can seriously influence the economics of sheep production. Ticks, lice, and mites can adversely affect the performance of sheep of all ages. Parasites will stress the sheep, causing them to become unthrifty. Resultant irritation causes wool damage because of rubbing by sheep. In addition, the parasites directly damage the wool fibers. Pressure-applied sprays, dusts, and pour-ons have mostly replaced the dipping vat of years past. Take care to use preparations approved of and recommended for sheep.

Internal Parasites

Controlling internal parasites is a never-ending battle for the shepherd. Gastrointestinal parasites commonly cause severe problems among closely grazing animals. The most effective way to control parasites is to interrupt their life cycle and thereby prevent infective larvae from gaining access to the sheep.

Some intestinal parasites can become dormant or inactive during the winter months. The parasites seal themselves off in the wall of the intestine and become inactive. At this stage they are not affected by most deworming agents.

Levamisole appears to be effective against the inactive stage. Other new systemic anthelmintics also show promise of being useful against these stages. Your veterinarian or county Extension adviser will know when these products become available for use in sheep.

Research indicates that several of the newer classes of anthelmintics will be useful for sheep when the parasites are active in the gut. The newer benzimidazoles, pyrantel tartrate, and an oral form of ivermectin all appear to be more effective against many gastrointestinal worms.

Flock owners need to develop a specific program for their flocks. Total numbers, facilities, management practices, goals, and available acreage all have a bearing on control measures. Your veterinarian can best advise you on which drugs and schedules to use. Veterinarians can also do periodic fecal examinations, 7 to 10 days postworming, to assess the effectiveness of the program.

Pasture rotation may also be of value if sufficient acreage is available to allow a significant rest period for fields not in use.

Coccidiosis. This disease has become widespread among sheep. It causes diarrhea and death in lambs. Coccidiosis contributes significantly to the incidence of prolapsed rectums in feeder lambs.

Coccidiosis is an intestinal parasite that develops in the gut wall. When released, it causes severe inflammation and bleeding from the gut wall. Decreased nutrient absorption results because of the scar tissue that is formed after healing. Lamb performance is often hindered due to this scar tissue formation.

Coccidiosis is a highly contagious infectious disease spread by unsanitary conditions. Feeders and waterers must be constructed to prevent fecal contamination either directly or by hooves tracking manure into feeders.

Adult sheep develop some immunity following exposure to coccidia. However, they will still continue to harbor some parasites and shed oocysts (eggs) in their feces. This is a source of infection for the lambs.

Coccidiostats at present are not approved for use in sheep. Research indicates that several available products show promise.

Your veterinarian can provide diagnosis and specific recommendations for drug usage.

Foot Health

It is very important to keep the feet of all sheep well trimmed. Foot problems keep sheep from performing at the highest level. These problems are much easier to prevent than to cure.

Suggestions for Foot Care

1. Trim the feet of all sheep twice a year. Use a sharp knife, pruning shears, or foot rot shears. Then run all sheep through a footbath.
2. Isolate all new sheep until their feet have been carefully inspected and trimmed, and run sheep through a footbath.
3. Do not allow sheep to travel through deep mud or manure.
4. Catch lame sheep and examine their feet as soon as you notice the lameness.
5. To minimize pasture contamination, isolate all sheep that have any type of foot infection.
6. Sell for slaughter all sheep that do not respond to treatment.

Foot problems may be caused by foot rot, foot abscess, and foot scald; lack of timely and proper foot care; poor foot development caused by tissue abnormalities, nutrition, and genetics; injury from cinders, gravel, and plant stubble.

Some infectious diseases can also cause lameness problems, such as soremouth, lip and leg ulceration, white muscle disease, and blue tongue infection.

Foot Rot¹

Foot rot is a highly contagious disease; in severe outbreaks it may affect up to 75 percent of a flock at a time. The infection may persist for years in the feet of sheep but dies in soil, usually within 14 days. Although the mortality rate from foot rot is low, loss of condition among adult sheep and nursing lambs and the increased labor, equip-

¹Adapted from *The Sheepman's Production Handbook*.

ment, and materials required to treat the disease make it one of the most costly of sheep diseases. Foot rot is infrequently seen in areas with sandy, well-drained soils and in regions with low rainfall but may be a major problem on irrigated pastures, wet lowland pasture, and high-rainfall areas.

Foot rot commences with inflammation of the skin at the skin-hoof junction, which leads to a progressive necrosis of the deeper layers of the epidermis. This in turn causes an underrunning of the horn, inflammation of the sensitive laminae of the foot, and severe lameness. Foot rot primarily invades the horny hoof and spreads rapidly throughout the horny tissue. There is a foul-smelling, characteristic discharge but no abscesses are formed. The hoof growth often becomes distorted, and frequently sheep will put little or no weight on an affected foot. The organisms causing foot rot require an oxygen-deficient environment for growth. Therefore, overgrown, rolled-under hooves in wet, muddy, unsanitary conditions provide an excellent environment for these organisms. The well-worn or trimmed hoof is less affected.

There is great variation in the incidence of the disease, which is influenced greatly by weather and temperature. Concentrating large numbers of sheep in small areas contributes to the rapid spread of the infection. Walking over contaminated areas where infected sheep have been is the principal method of transmission. Complete control can seldom be accomplished in one season but requires a carefully planned inspection program for several years.

Control. To effectively control foot rot, inspect all feet of all sheep in the flock. Where foot rot is a problem, a control program should be initiated during the dry season and strictly adhered to regardless of weather conditions or development of foot rot problems.

1. Trim all feet of every sheep and treat sheep in a footbath. If hooves are dry and hard, soaking the feet in a footbath or wetting the holding corral will facilitate trimming.
2. Identify affected sheep and isolate as a hospital band.
3. Retreat affected sheep a minimum of every three days for at least four treatments.
4. Inspect affected sheep every two weeks.
5. Place recovered sheep in a convalescent band.
6. Sheep in the convalescent band that pass two clean inspections 30 days apart and are treated at the time of each inspection may be returned to the clean band.
7. Treatment of the infected band should continue as required by individual sheep.



The picture on the left shows a sheep with one hoof that needs trimming and one that is properly trimmed. A commonly used foot trimmer is also shown. Note in the picture on the right how much better the sheep can stand on the hoof that has been properly trimmed.

8. The clean band must pass two inspections 30 days apart in which no affected sheep are discovered. Inspect the clean flock twice yearly.
9. New sheep must be isolated and pass two inspections 30 days apart before being introduced into the flock.
10. When the flock is inspected, clean sheep must go to a pasture that has had no sheep on it for at least two weeks.
11. Individual treatment with systemic antibiotics is sometimes necessary.
12. Topical use of 10 percent chloramphenicol in alcohol has proved beneficial in difficult cases.

Foot Abscess¹

Foot abscess is a widespread disease that occurs sporadically. It is infectious but not contagious like foot rot or foot scald. Foot abscess is a disease of the soft structures of the foot. The conditions under which foot abscess occurs may be varied and are related to several contributing factors. Foot abscess may occur under extremely wet or

¹Adapted from *The Sheepman's Production Handbook*.

muddy conditions, after severe trimming in wet weather, after sheep have been placed on stubble (particularly barley or safflower stubble), and in conjunction with severe outbreaks of foot rot.

The infection may penetrate the toe or sole, causing no visible swelling, or it may gain entry between the heels, where it produces granulated tissue and then severe swelling. In the toe infection, the foot becomes hot and tender. Frequently a sore spot can be located. If drainage can be established, the foot will rapidly return to normal. When the infection invades the heel and small areas of granulation tissue develop, the foot is painful to the animal and frequently swollen above the coronet. Joints and tendons may become involved, and permanent lameness may result.

Treatment consists of thoroughly paring out the abscess and then applying a medicated dressing and administering systemic antibiotics. The sheep should be isolated and kept on soft, clean footing or on slotted floors until the feet have healed.

Foot Scald¹

Foot scald is a contagious disease caused by the same organisms or perhaps a different strain of the same organisms that cause foot rot. Foot scald may actually be an early, superficial form of foot rot. Foot scald is rather sporadic in its occurrence and is found mostly during periods of extremely wet weather.

Although in the early stages foot scald resembles foot rot, in later stages it is much less severe. Foot scald commences with inflammation of the skin between the claws and progresses to the rear portion of the heels, causing them to separate from the hoof. Sheep may be slightly to moderately lame, depending on the stage of infection. Apparently, the forefeet are more often affected than the rear feet.

Foot scald usually responds well to astringent footbaths. Penning the sheep in a dry area or on slotted floors is also helpful.

Footbath Solutions

Several products have been shown to be effective as footbath solutions. Twenty percent copper sulfate solution, 10 percent zinc sulfate, or 10 percent formalin solution have all proved useful in footbaths. Copper sulfate needs to be handled carefully. Sheep ingesting this can develop copper poisoning. Three to five minutes of contact with any of these solutions are required for maximum effectiveness.

¹Adapted from *The Sheepman's Production Handbook*.

Zinc sulfate is usually most effective when used on a daily basis for at least 7 to 10 days.

Sheep-Handling Facilities

Many producers still handle their sheep by the age-old method of "brute strength and awkwardness." However, there is a much easier way, and that is to develop a good sheep-handling facility. You can build your own facility or purchase one of several good commercial units. Your working facility should be developed to the size of operation you have or plan to have in the near future. (See photographs below.)

There are many things you can use a good working facility for, such as sorting ewes into several groups; separating lambs and ewes; checking udders, ear tags, mouths, or breeding marks; paint branding; pregnancy checking; deworming and vaccinating. In addition, you can weigh sheep by placing a scale at the end of the chute. A cradle can be placed in the chute arrangement so you can easily trim feet, using a minimum of labor.

Sheep-handling facilities add a new dimension to sheep production. Used correctly, they can enhance the efficiency of your total operation.



A good sheep-handling facility greatly reduces labor.

Lamb Marketing

Even though lamb prices have been quite variable during recent years, they have often peaked in late spring and early summer.

Large-framed, rapid-gaining lambs that will grade Choice or Prime should be marketed at approximately 110 to 115 pounds, or even 5 or 10 pounds heavier if they will not be penalized in price. Small-framed lambs that finish out at light weights should be marketed at approximately 95 to 100 pounds.

Lambs should be pushed for an early market. If they are carried through the summer, they often gain more slowly and less efficiently, have more parasites, grade lower, and have a higher death rate.

Most Illinois lambs are sold through terminal markets, local pools, sale barns, by electronic marketing, or direct to a packer. Electronic marketing is the newest marketing system, and it appears that a rapidly increasing number of Illinois lambs will be marketed this way in the years ahead. In addition, an increasing number of producers are developing their own markets by selling lambs to people and by having them slaughtered and processed through a local locker plant. Your choice of a market will depend on current prices, marketing opportunities in your area, the number of lambs you have to sell, and available transportation.

Easter lambs are milk-fat lambs weighing 40 to 45 pounds. They are sold to meet the demand during the Easter season. Although the price per pound for Easter lambs may seem high, the most important consideration in selling to this specialty market is the number of dollars you will receive per head. Lambs that are ready for the Easter market in late March or April will probably weigh 90 to 100 pounds in June — the normal peak period in spring lamb prices — so you must figure carefully to find the most profitable way to market such lambs.

Lamb Carcass Shows

Lamb carcass shows provide sheep producers with an opportunity to evaluate their product and thereby guide their decisions in management, breeding, and feeding. A carcass show does not in itself represent the endpoint of lamb production in terms of lean, high-quality meat; however, carcass data are vital if producers are going to market lambs that are acceptable for *all* segments of the industry.

A quick evaluation of the Illinois State Fair Lamb Carcass Show data from 1978 to 1982 reveals the need for renewed emphasis on carcass improvement.

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Number of entries	48	40	55	55	62
Number qualified	27	15	16	18	23
Percent qualified	56	38	29	33	37
<u>Disqualifications</u>			<i>percent</i>		
Rib eye area	37	58	69	67	60
Fat thickness	6	10	9	4	6
Quality grade	5	5	5	0	8
Yield grade	0	0	3	10	3
Carcass weight	5	2	0	4	2

An obvious need to produce lambs with more muscle, especially larger rib eyes, is quite evident. Retail meat cases displaying large, meaty rib and loin chops are a must if lamb is to compete with other red meats and with poultry and fish in the marketplace.

The major lamb carcass program in Illinois is the Illini Lamb Premiere Program, developed to identify fast-growing, efficient lambs. The ideal lamb should have a high carcass weight per day of age (0.5 to 0.6 lb) and a large rib eye (2.6 to 3.2 sq. in.). In addition, the lamb should be free of excessive internal fat (1.0 to 2.5 percent) and external fat (0.10 to 0.20 in.) and possess desirable quality (at least average Choice) as indicated by youthfulness and other measures of palatability.

Requirements of the Illini Lamb Premiere Program

1. Lambs must be nominated, weighed, and tattooed before they are 31 days old and on or after January 1.

2. Lambs must be castrated prior to tattooing and must be identified by a special ear tattoo followed by an individual animal number.

3. To qualify, lamb carcasses must meet the following requirements:

- a. Have a minimum hot carcass weight of 45 pounds.
- b. Have at least 0.10 inch of fat cover at the rib eye.
- c. Have a quality grade of average Choice or better.
- d. Have a maximum yield grade of 3.99.
- e. Show no signs of being yearling mutton or being affected with cryptorchidism.

f. Meet the rib eye area requirements listed below:

<u>Hot carcass weight (lb)</u>	<u>Minimum REA (sq. inches)</u>
40-45	2.2
46-50	2.3
51-55	2.4
56-60	2.5
61-65	2.6
66-70	2.7
71-75	2.8
76-80	2.9
81-85	3.0
86-90	3.1
91+	3.2

Carcass Evaluation Procedure for the Illini Lamb Premiere Program

Final carcass placing is based on a combination of production and carcass merit. Carcass merit is determined as follows:

1. A preliminary carcass index using estimated percent boneless retail cuts (based on the carcass yield grade) is obtained from Table 16.

2. The estimated percent of boneless retail cuts is adjusted to obtain a final numerical index. Those adjustments should be made as follows:

a. Add 0.3 points for each third of a grade above average Choice. Additional points will not be added to those carcasses grading higher than low Prime. Subtract 4 points for Good grade carcasses.

b. Add 1.0 point for each 0.1 square inch of rib eye over the minimum found in Table 16. Subtract 1.0 point for each 0.1 square inch below the minimum rib eye requirement. These adjustments are particularly appropriate among groups of carcasses varying little in external fat thickness, especially at the rib eye.

3. Carcasses are then ranked according to the adjusted index, with the highest value being the most desirable. If ties should occur, rib eye area per hundredweight of carcass followed by USDA quality grade differences could be used to break the ties.

4. After a carcass index has been calculated for each carcass, rank all *qualified* lamb carcasses from the highest to the lowest index. Next,

rank all lamb carcasses according to their carcass weight per day of age, considering the highest values as the most desirable. Finally, add the numerical rankings from the carcass division and performance division of each *qualified* lamb carcass and rank from the lowest to highest numerical score. The lamb carcass with the lowest numerical score wins the Premiere Carcass Show.

Table 16. Percent Boneless Retail Cuts of the Major Wholesale Cuts by Yield (Cutability) Grade

Yield grade	Yield of boneless retail cuts, %	Yield grade	Yield of boneless retail cuts, %
0.1	50.9	3.1	45.2
0.2	50.5	3.2	45.1
0.3	50.3	3.3	44.9
0.4	50.1	3.4	44.7
0.5	50.0	3.5	44.6
0.6	49.8	3.6	44.4
0.7	49.6	3.7	44.2
0.8	49.4	3.8	44.0
0.9	49.2	3.9	43.8
1.0	49.0	4.0	43.6
1.1	48.8	4.1	43.4
1.2	48.7	4.2	43.3
1.3	48.5	4.3	43.2
1.4	48.3	4.4	43.0
1.5	48.2	4.5	42.8
1.6	48.0	4.6	42.6
1.7	47.8	4.7	42.4
1.8	47.6	4.8	42.2
1.9	47.4	4.9	42.0
2.0	47.2	5.0	41.8
2.1	47.0	5.1	41.6
2.2	46.9	5.2	41.5
2.3	46.7	5.3	41.3
2.4	46.5	5.4	41.1
2.5	46.4	5.5	41.0
2.6	46.2	5.6	40.8
2.7	46.0	5.7	40.6
2.8	45.8	5.8	40.4
2.9	45.6	5.9	40.2
3.0	45.4	...	...

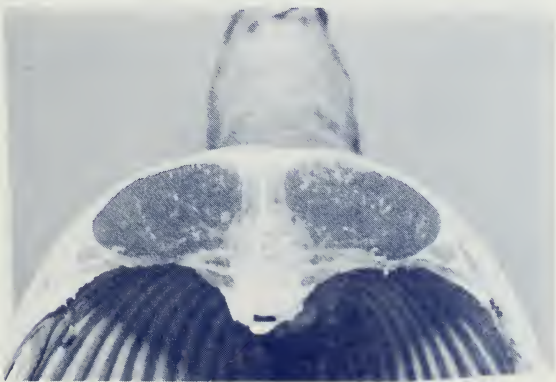
The following carcass information was obtained from the 1982 Illinois State Fair Champion Carcass:

Live weight.....	110	Fat thickness over the loin	0.12
Hot carcass weight	63	Fat thickness over the lower rib....	0.23
USDA grade.....	C+	Rib eye area	3.05
Lb of carcass	0.534	Percent kidney fat.....	3.00
Per day of age		USDA yield grade	2.60

The 1982 champion yielded a carcass that would meet all requirements demanded by the packer, wholesaler, retailer, and consumer. In addition, the wether was also a fast-growing, efficient lamb as indicated by 0.534 pound of carcass per day of age. Such a lamb serves as a model for the lamb industry.



The production of fast-gaining lambs that have trim, heavy-muscled carcasses should be one of the goals of all sheep producers. The carcass (left) and loin eyes (below) are from such a lamb.



All those who enter carcass shows are to be congratulated. We hope their interest in improving the ultimate product of the lamb industry will pay large dividends in the future.

Wool Production and Marketing

Value of Wool

Harvest the wool crop carefully, for it is one of the most valuable products sold from the farm, and in many cases it is one of the most poorly managed.

Fleece weights of brood ewes and rams are important. For example, take two extremes, one ewe shearing 7 pounds and another shearing 14 pounds. With strong prices for both lamb and wool (including incentive payment), the light-shearing ewe would have to raise 14 to 16 pounds more lamb than the heavy-shearing ewe in order to produce the same gross income. It may be well worth your time to pay more attention to the fleece weights of your breeding stock.

Care and Marketing of Fleeces

Working at a wool pool and watching wool come in to be graded show that wool is one of the most poorly handled farm products marketed. Some sheep producers get only half of what their wool should have been worth, because they have marketed fleeces that are full of hay, straw, burrs, manure, mud, or other foreign materials. Fleeces are often tied with everything from baling wire to binder twine. *Paper twine is the only acceptable product for tying fleeces.*

When you shear sheep and handle fleeces, follow these important procedures:

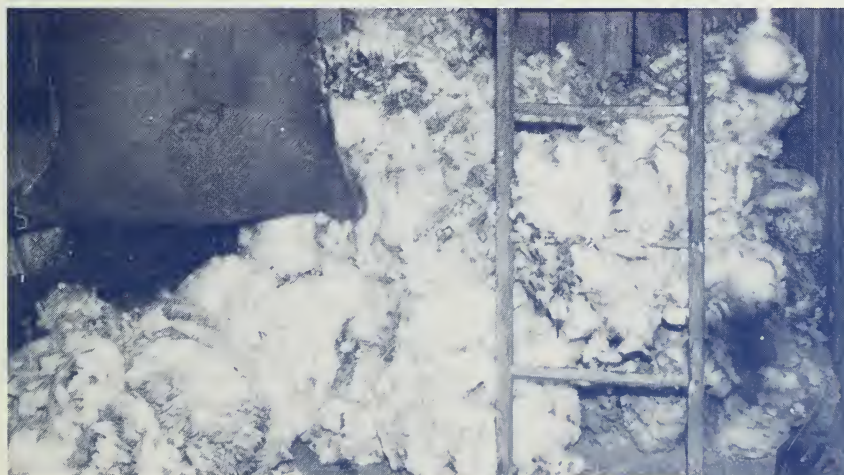
1. Shear only when the wool is dry.
2. Clean the straw off the belly and legs before starting to shear.
3. Shear on a clean, dry surface. A piece of old carpeting or a piece of plywood works well.
4. Avoid second cuts; remove the fleece in one piece.
5. Remove all tags, dung locks, and stained wool from the fleece, and bag them separately.
6. If there is a lot of hay, chaff, or other material in the neck area, remove this section of the fleece and bag it separately.
7. Bag separately black fleeces or fleeces with a large amount of black in them. Remove black leg and face wool from the fleece and bag with black fleece wool.

8. Roll fleece with the flesh side out and tie securely, but not too tightly, into a neat package.
9. *Tie fleeces with paper twine only.*
10. Tie fleeces separately. Do not tie several together.
11. Be sure fleeces are not contaminated with black plastic. This has become a very serious problem, in fact, serious enough that several wool manufacturers have instructed their buyers to reject any wool that shows signs of being contaminated with plastic twine particles.
12. Store the tied fleeces in a wool bag in a clean, dry area that is protected from dust, dirt, and rodents. Do not store in plastic bags (the kind used for garbage or lawn clippings) or paper bags.

If you live in an area that holds a wool pool, it may be to your advantage to market through the pool. At least check present wool prices before you sell to local buyers, so you will have an idea what your wool is worth.

Wool Grades

The current U.S. standards for grades of wool have been in effect since January 1, 1966. These standards designate 16 numerical grades designed to give the wool industry a more precise and objective means of evaluating wool grades. The grades still retain their traditional



Fleeces should be tied with paper twine and then stored in a wool bag.

numbers, which originally reflected spinning count. Spinning count is based on the number of hanks of yarn (each hank is 560 yards in length) that can be spun from one pound of wool top.

Present standards specify average fiber diameter limits for each grade in microns ($1/25,400$ of an inch). Each grade also contains limits on the variation in diameter allowed among the individual fibers in the lot. If the variability of the individual fibers is greater than the limits specified in the standards, the wool will be graded at the next, lower grade.

These standards also provide for the grading of wool by both visual appraisal and actual measurement of fiber diameter.

Before January 1, 1966, the American or blood system and the numerical system were both commonly used; however, producers generally refer to the blood system when discussing wool grades. In the blood system, wool is placed into one of seven major grades on the basis of the diameter of fiber. A comparison of the official U.S. grades and the blood system follows.

<u>Official U.S. grades</u>	<u>Average fiber diameter (microns)</u>	<u>American or blood system</u>
Finer than 80's	17.69 or less	Fine
80's	17.70-19.14	
70's	19.15-20.59	
64's	20.60-22.04	
62's	22.05-23.49	$\frac{1}{2}$ blood
60's	23.50-24.94	
58's	24.95-26.39	$\frac{3}{8}$ blood
56's	26.40-27.84	
54's	27.85-29.29	$\frac{1}{4}$ blood
50's	29.30-30.99	
48's	31.00-32.69	Low $\frac{1}{4}$ blood
46's	32.70-34.39	
44's	34.40-36.19	Common
40's	36.20-38.09	Braid
36's	38.10-40.20	
Coarser than 36's	40.21 or more	

Marketing Wool

Selling your wool for the best possible price is important. A higher price per pound means not only a larger check, but also a larger wool incentive payment. Most Illinois wool clips are marketed through area wool pools, consigned to wool marketing cooperatives in neighboring states, or sold to wool buyers or their representatives.

When wool is delivered to area wool pools, each fleece is graded according to fineness, length, color, and cleanness. Each producer's clip is weighed by grade and stored with other fleeces of the same grade. At the end of the pool, the wool is sold by grade on a sealed bid basis. Consignors are paid for their consignments on the basis of grade and sales price.

Wool cooperatives from several neighboring states are accepting wool on a consignment basis through Illinois points. Wool delivered to one of these points is weighed and a cash advance or partial payment is made. The wool is shipped to the cooperative's warehouse to be fleece-graded. Each grade is weighed and stored or shipped with other wool of the same grade. The consignor receives final settlement on the basis of grade and price received for that grade, minus the amount of the cash advance.

Wool sold to local dealers is usually sold on a cash basis. Many shearers also buy wool on this basis. These outlets may or may not pay a price differential for various grades.







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